Michael Jeffrey
from R.M.S.

April 9th 1943.

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John Carline Shrewsbury January 17[illegible]

The PRACTICE of PERSPECTIVE:

OR, AN EASY

METHOD

OF REPRESENTING

NATURAL OBJECTS

According to the RULES of ART.

Applied and exemplified in all the Variety of Cases; as LANDSKAPES, GARDENS, BUILDINGS of divers Kinds, their *Appendages*, *Parts*, and *Furniture*.

With RULES for the Proportion and Position of FIGURES, both in DRAUGHT and RELIEVO.

Alſo the Manner of conducting the SHADOWS, produced either by natural or artificial *Luminaries*; and Practical Methods of DRAWING after Nature, when the Proceſs of Rules are not underſtood.

A WORK highly neceſſary for

PAINTERS,

ENGRAVERS,	STATUARIES,
ARCHITECTS,	JEWELLERS,
EMBROIDERERS,	TAPESTRY-WORKERS,

And others concerned in DESIGNING.

The Whole illuſtrated with One Hundred and Fifty COPPER-PLATES.

Written in FRENCH by a JESUIT of *Paris*. Tranſlated by E. CHAMBERS, Author of Cyclopædia, or, An Univerſal Dictionary of Arts and Sciences.

The FOURTH EDITION.

If you would proceed immediately to the Practice *of* Perſpective, *without engaging in the intricacies of the* Theory; *the* JESUIT'S PERSPECTIVE *will anſwer your purpoſe.*
Wolfius in Element. Matheſ. Tom. II. P. 1048.

LONDON:
Printed for JOHN BOWLES, at the Black Horſe in *Cornhill*, and CARINGTON BOWLES, in *St. Paul's Church-Yard*.
[Price bound Twelve Shillings.]
MDCCLXV.

Hunton & Vellum

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[illegible]

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OF [illegible]

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[illegible] Copper-Plates.

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THE

PREFACE.

THE Art of PERSPECTIVE is moſt elegant and agreeable: It affords great entertainment to men of leiſure, and is the very ſoul of painting; without which a PAINTER can never be a maſter in his profeſſion. It is this muſt conduct him in the diſpoſitions, heights, and proportions of his figures, buildings, and other objects. It is this muſt ſhew him what colours are to be deep or faint, vivid or dull; where each is to be applied; what parts to be highly finiſhed, and what ſlightly touched; where light is to be beſtowed, and where diminiſhed. In a word, it is this begins and compleats the painting. Without the aſſiſtance of PERSPECTIVE, the beſt maſter muſt make as many faults as ſtrokes; eſpecially in buildings with their enrichments. In which particulars I find ſome reputable painters ſo greatly defective, that this has been one conſiderable motive to my undertaking the following work: Wherein their errors will be ſhewn, without naming the authors; and novices inſtructed how to avoid the like. The moſt conſummate maſter is tied to the ſtrict obſervation of theſe rules, on pain of pleaſing none but the ignorant: And an indifferent painter may be told this to his comfort, that if he make himſelf a thorough maſter of them, he will be able to do wonders.

THE ENGRAVER in copper can no more excel without PERSPECTIVE, than the painter; as having every thing to expreſs with the graver that the other performs with his pencil. From PERSPECTIVE he muſt learn where to lean heavily, and where lightly

on his graver; what ſtrokes muſt be ſunk deep, and what ſoftened. And his occaſion for this art is more important, as his pieces multiply to a much greater degree than thoſe of the painter; and, if artfully performed, will ſpread his praiſe more: But, if otherwiſe, his failing will be the more notorious, and each print be a monument of the author's ignorance.

The Sculptor and Statuary muſt here learn the heights both for the high, low, and middle ſight; the ſlopes and inclinations of buildings, and other bodies; the angle for the point of ſight; and the proportions and dimenſions of all objects, near and remote.

By the ſame art the Architect muſt learn how to make his deſigns intelligible in a little compaſs: How to raiſe one part, and leave the other in its plan, to ſhew the whole conduct and effect of his work. By the way, having mentioned architecture, I muſt obſerve of how much conſequence it is, for ſuch as practiſe Perspective, to underſtand the fundamental rules of that ſcience; the fineſt pieces of Perspective being thoſe of great and magnificent buildings, raiſed according to the order of columns; the beauty whereof depends on their juſt meaſures and proportions, which muſt be repreſented with the greateſt exactneſs, otherwiſe they will ſhock and offend the eye. Ignorance in theſe things is not excuſable, conſidering with how much eaſe they may be learned in *Vitruvius*, *Vignola*, *Scamozzi*, and ſome others.

To know the orders of columns and their characters, is not enough: A draughts-man ſhould likewiſe underſtand all the uſual dimenſions of buildings, and the ſeveral parts; as doors, windows *, chimneys, &c. how to diſpoſe them to receive the light to advantage, and that no part may appear maimed, uſeleſs, or ill ſupported, and that there be a ſymmetry and pro-

* Halfpenny's Practical Architecture, in 12mo, price 4 s. illuſtrates, by various uſeful tables, the exact meaſures and proportions of the five orders of columns, with doors and windows adjuſted to them.

portion

portion running throughout the whole. Without ſuch regulation, a piece of PERSPECTIVE, in which noble ſtructures have a place, inſtead of pleaſing the eye, will offend it.

GOLDSMITHS, EMBROIDERERS, TAPESTRY-MAKERS, ENAMELLERS, and even JOINERS, and others who have occaſion to make deſigns, are under the ſtricteſt obligations to attain the knowledge of PERSPECTIVE, if they would be eminent in their profeſſions.

MANY who deſired to improve themſelves by the ſtudy of this art, have aſſured me, that they were diſcouraged by the great number of lines which moſt authors make uſe of to form, and find the places of their objects. Others have been deterred by numberleſs obſcurities in the rules and operations, and often perplexed from the inſtructions not being immediately annexed to the figures. Now theſe complaints have warned me to be more clear and methodical in my inſtructions, and to place them fronting the copper-plates, ſo that the Reader may have both the rule and the example in his eye at once. Through the whole I have accommodated myſelf to the capacity of learners; not perplexing them with too many demonſtrations, nor uſing any words but ſuch as may be readily underſtood, at leaſt in the definitions. With the ſame view I have followed the common cuſtom of attributing qualities to certain things which really have them not. Thus, in conſidering diſtance, or removal, I have been forced to ſay, contrary to my own ſentiment, that it is the Pupil which receives the rays from objects, as if they terminate therein; whereas it is paſt diſpute, that viſion is performed on the *Retina* at the bottom of the eye; and that the rays only paſs through the pupil in the way thither: Which, to ſome people, will appear a new language, and not eaſily to be conceived. However, being aſſured that ſuch a piece of knowledge imported but little to the practice of PERSPECTIVE, I have attributed to the pupil what really belongs to the bottom of the eye, the proper place of viſion,

where

where the images of all objećts are formed; though there are others who refer this to the cryſtalline. The Reader who requires farther ſatisfaction in this point, may conſult *Aquillo Scheiner*, and *Des Cartes*.

Though I have ſtrained every nerve to render the ſcience eaſy, I do not doubt but there are ſeveral will find ſome difficulty at the beginning. But whoever can ſurmount the firſt difficulties, may reſt aſſured he will eaſily underſtand and practiſe the remaining rules, provided he takes care to maſter one rule well before he turn over the leaf to another. The rules, in ſome meaſure, depend on each other: And a little trouble, at firſt, will be abundantly recompenſed by the future eaſe accruing from it.

It will appear from the following table, that this work alone ſuffices to carry you through all the ſtages and degrees of Perspective, and to perform every kind of draught; having recourſe to the ſeveral rules, and collating them together, to furniſh out the performance required. No doubt it muſt be agreeable to any one, who deſires to produce a compoſition of his own, to find immediately rules that will anſwer his purpoſe: His ſatisfaction, aſſuredly, muſt far tranſcend that of barely copying the deſigns of others; and, in caſe he be obliged to copy any other, he will do it with much more eaſe and pleaſure, when maſter of theſe rules, in which inſtructions are given for every thing that can occur. I take great pleaſure in making new deſigns, and inventing new figures; which I ſhould have made public, as my predeceſſors have done, but that I was willing every perſon ſhould participate in the pleaſure of compoſing from his own fancy; having furniſhed him with all the means requiſite thereto. Such as chuſe to decline that trouble, will meet with deſigns enough ready to their hand in *Marolois*, *Vredeman*, *Urieſſe*, and others, who have ſhewn the politeneſs of their genius in this way.

So

So many fine performances, I doubt, have helped to render many of our painters too lazy to learn to do what they find ready done. All they aſpire at is to copy them as well as they can; which were excuſable, did they know how to do it with judgment: But their way is to copy without underſtanding the rules of proportion and beauty, or, in other words, the rules of PERSPECTIVE. And hence it is, that we have often as many different points in a painting, as there are objects, lines, and returns. Some of them will let you ſee the bottom of an object that ſhould only ſhew the top; and others, rather than be defective, will ſhew both. Others again, having ſeveral figures to ſhew in a painting, will make them all of the ſame height: Though ſometimes they vouchſafe to diſpenſe with that rule, and make thoſe in the fore-part leſs than thoſe behind, to give room, as they tell us, for the hind figures to be ſeen: Which is to overturn both art and nature at once.

As to the order of this work, I have divided it into five parts. In the FIRST are delivered a few definitions, demonſtrations, and reaſons, which need no great ſtock of mathematics to be underſtood, and yet give a deal of light into the ſubject. Thence I proceed to ſhew the nature of the point of ſight, points of diſtance, accidental points, front point, and ſide point; viſual rays, diagonals, parallels, perpendiculars, and baſe line. The previous knowledge of which things is very neceſſary to the eaſy underſtanding the inſtructions that follow. In the SECOND PART * I give the methods of ſhortening and diminiſhing plans divers ways; with ſeveral forms of pavements, which ordinarily ſerve for the foundations of Perſpective Draughts. Having given ſufficient inſtructions for putting all ſorts of planes in PERSPECTIVE, I proceed, in the THIRD PART †, to the elevation of divers objects, beginning with the eaſieſt, which are cubes, and other bodies of ſeveral ſides or faces. Theſe are followed by

* See Page 19. † See Page 42.

walls,

walls, doors, windows, cielings, vaults, and ſtair-caſes of divers forms; all without ornaments, or mouldings, that the rules might be leſs perplexed with a number of lines which ſuch enrichments would have rendered neceſſary. After ſhewing all the buildings in their ſimplicity and nakedneſs, I go on to furniſh them with columns, cornices, and other ornaments, which add a majeſty and grace. The houſes all built to the roof, I ſhew how to put them in PERSPECTIVE with variety of coverings: Then proceed to the inſides, and give rules for the furniture, moveables, *&c.* Theſe are followed by inſtructions relating to ſtreets, gardens, trees, walks; which are pleaſing objects, and render the draughts very entertaining. This part is cloſed with two or three contrivances for drawing after nature, when the rules of PERSPECTIVE are not underſtood. In the FOURTH PART * is given the meaſures and proportions of figures, their poſtures, ſituation, and horizons, both for flat paintings and relievo's. The FIFTH and LAST PART † conſiders natural ſhadows, whether projected by the ſun, torch, candle, or lamp.

WHEN the PERSPECTIVE of a building, garden, range of trees, paliſade, or the like intermixed with figures, is intended, I would recommend it to you, to ſketch out what relates to the PERSPECTIVE with a pencil in the firſt place; which done, you will proceed with more aſſurance to fix the heights of figures, and other circumſtances.

ONE thing ſome people will find to cenſure in this work, namely, That the points of diſtance in all my figures are too near the point of ſight. But if this be a fault, it is a voluntary one. For my deſign being to teach, it was neceſſary every thing ſhould be ſhewn, and the reader led to ſee where ſo many lines were to terminate; otherwiſe he would have been left to his own conjectures. It is ſufficient that I direct the learner to place them farther off; and even ſhew the laws and occaſions thereof. Nor can it be ſuppoſed I ſhould have ſcrupled making them more remote, had not other conſiderations prevailed with me: One of

* See Page 122.
† See Page 129.

which

which was, to render the book as ſmall, convenient, and cheap as poſſible. Had I followed the advice of ſome of my friends, I ſhould only have given a ſingle inſtruction in each leaf; which would have ſwelled the book to about thrice its bulk, without rendering it a whit the more intelligible.

Some people affect to conceal the names of the authors they have followed; and, as has been well obſerved of a certain one, pilfer from private perſons what they give to the public. For my own ſhare, I confeſs, that having propoſed to write a little treatiſe of Perspective, I was willing to ſee as many authors as I could on the ſame ſubject; nor made any ſcruple of borrowing from any of them what I found to my purpoſe, with an intention of making an open reſtitution of all my private thefts to the public. The firſt writer of any account is *George Reich*, in the Tenth Chapter of his works. The next, *Victor*, a canon of *Toul*, who gives us a number of good figures, but is too ſparing in his inſtructions. After him comes *Albert Durer*, who has left us ſome rules and principles, in the Fourth Book of his *Geometry*. Then *J. Couſin*, who has an expreſs Treatiſe on the Art of Perspective, wherein are many valuable things. After theſe come *Dan Barbaro*, *Vignola*, *Serlio*, *Du Cerceau*, *Sirigaty*, *Solomon de Caus*, *Marolois*, *Vredement*, *Urieſſe*, *Guidus Ubaldus*, *Pietro*, *Acolty*, the Sieur *de Vaulizard*, the Sieur *Deſargues*, and lately Father *Niceron*, a Minim: All whom I have read, one after another, and not without admiring their great and happy induſtry in the ſervice of the public; eſteeming it ſufficient honour for me to imitate what they have done, and to be the unknown copiſt of their works. Beſides thoſe already recited, there are many others whom I have never ſeen; which multitude of authors muſt be allowed an argument of the great eſteem the art has always been in, as well as the ſuperior regard paid to it by the preſent age. On this conſideration, I cannot doubt but the following work will be favourably received; eſpecially as it brings along with it ſeveral new rules and inſtructions, for putting in Perspective any of the objects our ſenſes are ordinarily converſant about; and, by conſequence, of truly performing whatever relates to that Art.

A

T A B L E

DIRECTING TO

The ſeveral Parts and Members whereof any PERSPECTIVE DRAUGHT is to conſiſt.

PERSPECTIVE muſt begin with plans, and, of courſe, with ſuch as are the moſt ſimple and eaſy; among which is the ſquare, or cube. The method of making the plan is ſhewn in page 19, and that of its elevation in page 44, 49. If an angular view be required, its plan is given in page 20, and its elevation in page 50.

A Cube view'd in Front, and Angle-wiſe.

To raiſe the walls of a houſe, or the paliſades of a garden, &c. ſee the plans and elevations, page 51, 52.

Walls and Paliſades.

Such as require the inſide of a hall, or chamber, in a front view, muſt take the ſame page 52 for the walls; the following page for the doors; page 54 for the windows; and page 77 for the chimney. The pavement they will find in page 31, 32, 33, and 34. The ceiling is ſhewn in page 55, 56, 57, and 58. If a door is to be open, you have your inſtructions in page 53, and the page following gives a window or caſement open. The ſame rules are to be obſerved when there are two or three ſtories over each other, as in page 76. To aſcend to theſe ſtories, ſtair-caſes are furniſhed in page 82, 83, and 84.

Inſide of a Room. The Walls. Doors. Windows. Chimney. Pavement. Ceiling. Stair-caſe.

Houſes viewed on the inſide are uſually ſeen furniſhed with moveables; moſt kinds whereof are ſhewn in page 96--103. The proportions of figures to be placed therein are found in page 122, 123, 124, 125.

Moveables.

To ſhew the inſide of a church, the plan muſt be put in perſpective, according to the inſtructions in page 37, or 41. The walls to be raiſed, from page 51. The windows are conſtructed by the ſame rules as the arches of page 62, or 54. Pillars and pilaſters are to be taken from page 48. Columns from 87. A vault, or vaults, from page 68---72. And a dome, or cupola, from page 74, 75. To enrich it with cornices, mouldings, and other ornaments, have recourſe to page 88---92. For altars, to page 104.

Inſide of a Church. Windows. Pilaſters. Columns. Vault. Dome. Cornices and Mouldings. Altars.

For outſides of buildings: The doors and windows are performed as in the inſides, ſee page 53, 54, and 106. When raiſed

Outſides of Buildings.

to the proper height, the method of roofing and covering them will be found in page 107, 108. And if a cornice or other ornaments be required, you have them in page 88---92. Arched galleries, both within and without ſide, are ſhewn in page 63, 66, and 67.

Cornice.

Galleries.

Street.

Houſes far off.

If a whole ſtreet be required, you muſt multiply the houſes on either ſide, as in page 109. When houſes are made pretty deep within the draught, ſee page 110. In large ſquares, &c. a pyramid may be erected, as in page 144. Or ſome ſtatue, figure, or a pedeſtal, as in page 91, and 124.

Pyramid.

Buildings viewed by the Angle.

When a building is to be viewed by the angle, you may take its plan from page 19, 30, and 111. and manage the elevation as taught in page 50, and 111. which give rules for doors and windows therein.

Gardens.

Arbours.

Paliſades.

Alleys of Trees.

Fountains.

Gardens in perſpective are exceeding agreeable. Their plans are to be made as in page 35, 38, or 113. If arbours be required, you are ſupplied from page 60, or 61. If paliſades, look to page 51, and 52. And if you prefer a grove, thicket, or walk planted with trees, page 112 furniſhes variety of each. If fountains, or *jets d'eau* be wanted, page 29 gives a baſon, and its elevation is performed as in page 73. For ſquares, or beds, ſee page 35, or 38. For polygons, 45, or 46. For placing ſtatues, or figures in a garden, take the meaſures from page 122, or 125. For grotto's, or niches, ſee page 74. For an aſcent out of one garden into another, you have divers forms of ſteps in page 78, 79, 80, 81. In fine, you are at liberty to chuſe whatever pleaſes your fancy, and may range them all in the ſame piece, provided you avoid confuſion, and obſerve the due ſymmetry and proportions.

Steps.

Shops.

If you would have open ſhops, without any fixtures, you are furniſhed in page 55. If you require them fitted up with drawers, boxes, &c. look to page 95, and 105.

Boxes.

Amphitheatres.

Amphitheatres were antiently of more uſe in paintings than at preſent, for which reaſon I have choſe to omit them: And yet ſhift might be made, by taking the plan in page 29, and adding more circles, according to the number of ſtories intended. To raiſe the ſtories, you are to uſe the line of elevation in page 75.

Fortifications.

For fortifications, you have the method of diminiſhing their plans in page 39, and the method of raiſing them in page 114.

Shadows.

To give the ſhadows to bodies of all kinds, both thoſe occaſioned by the ſun, candle, and torch, is ſhewn from page 129, to the end of the book.

See particulars in the following Table of Contents.

THE

THE

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A ſtair-

PART IV.

Meaſures and Proportions of Figures.

PART V.

Methods of finding the natural Shadows of Objects, projected either by the ſun, candle, torch, or lamp.

Fig. the 1st.

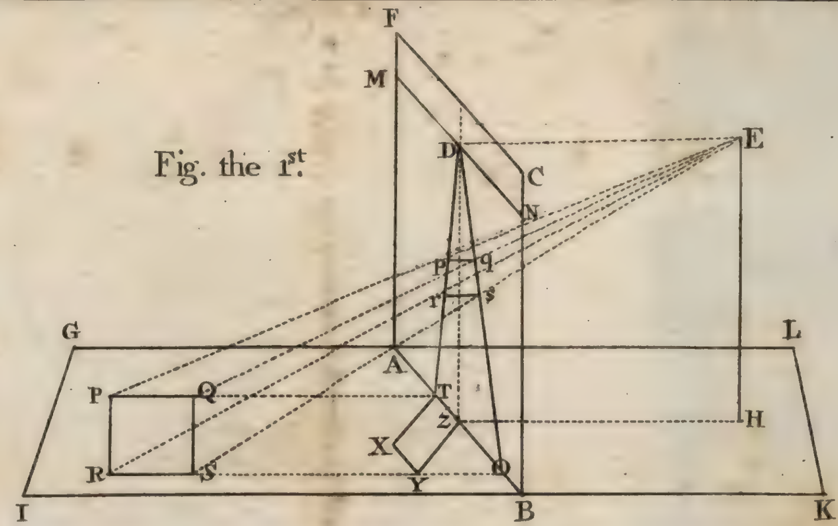


Fig. the 2d.

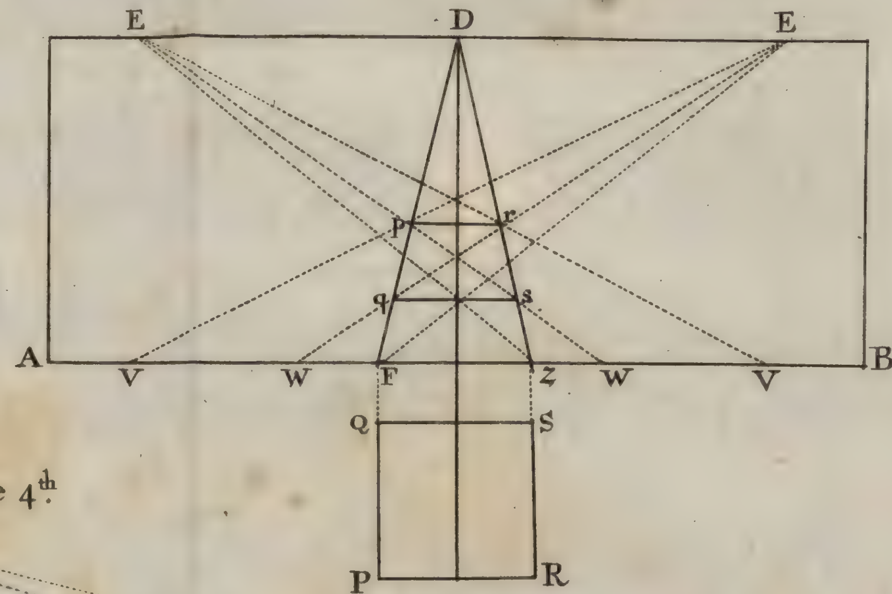
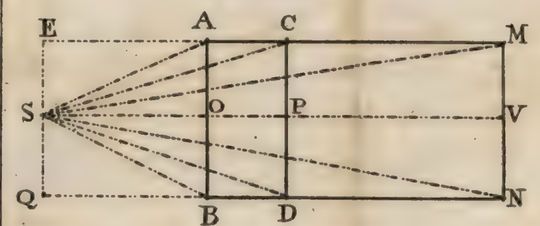


Fig. the 3d.



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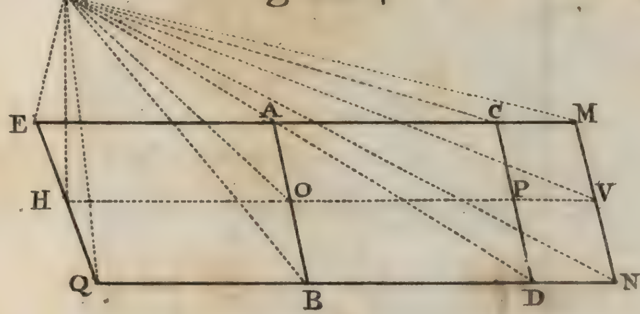

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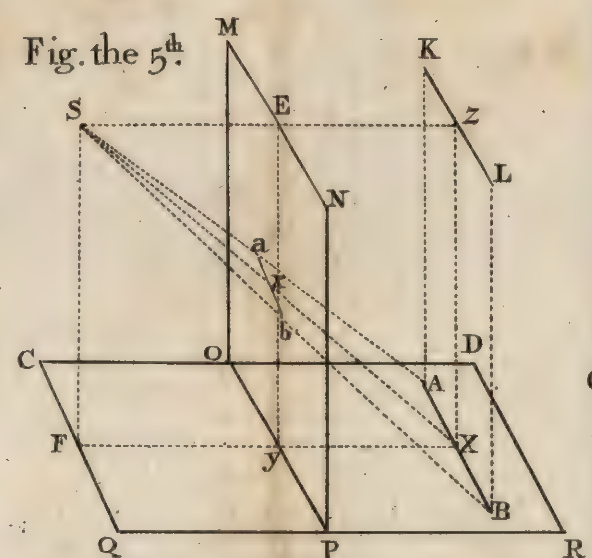

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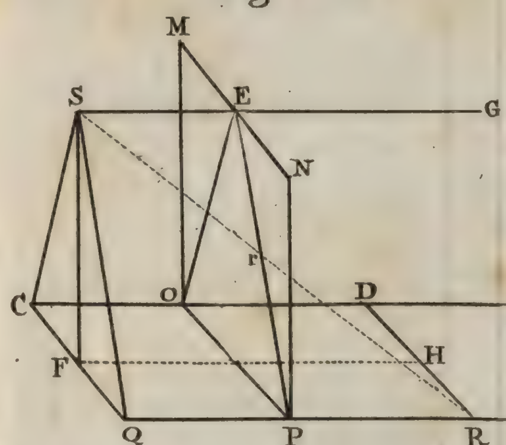

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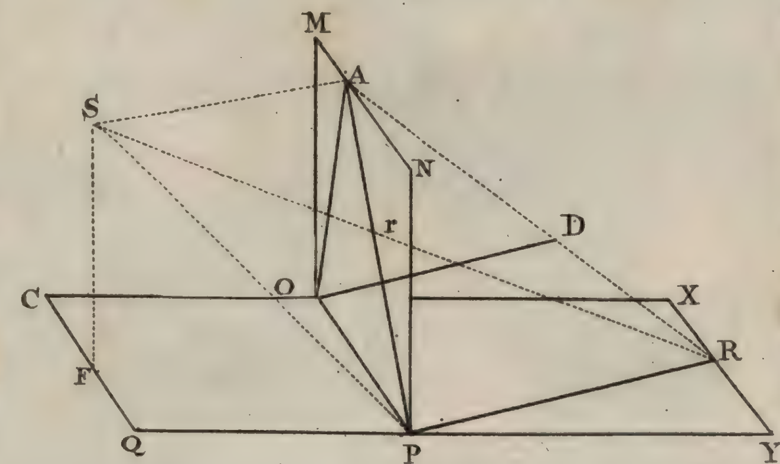


Fig. the 8th

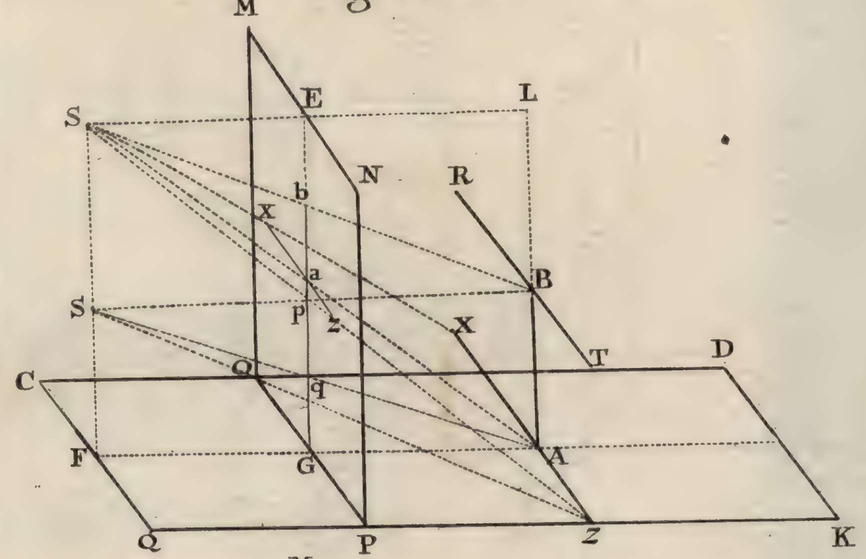


Fig. the 9th

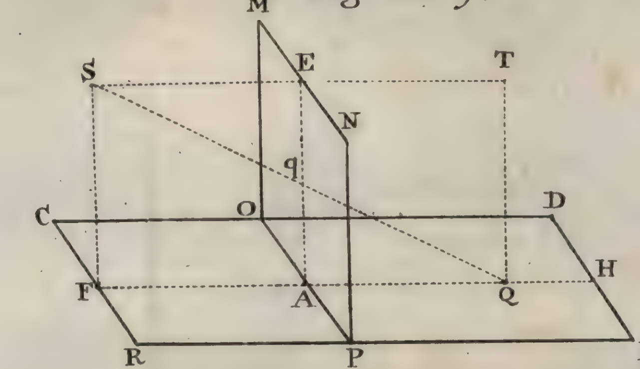


Fig. the 10th

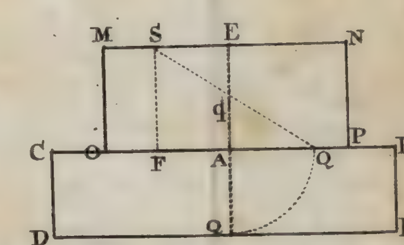


Fig. the 11th

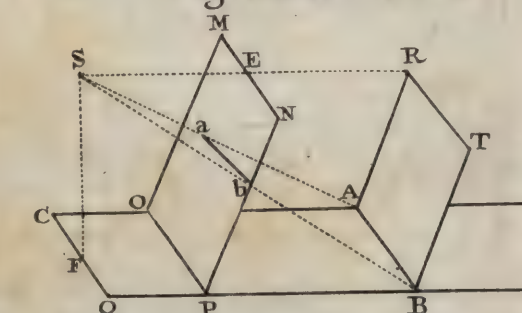


Fig. the 12th

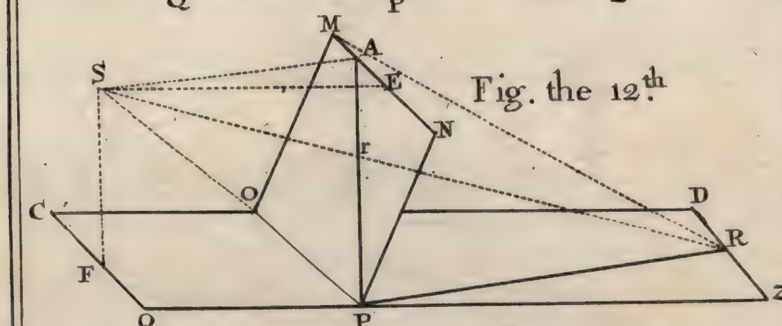


Fig. the 13th

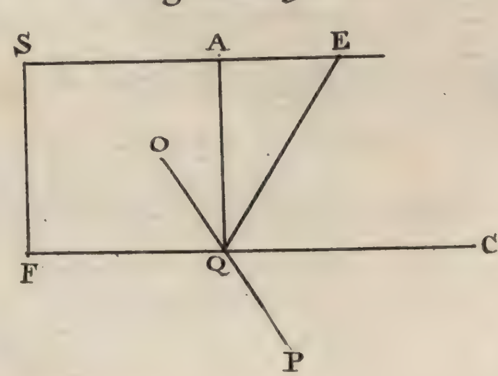


Fig. the 14th

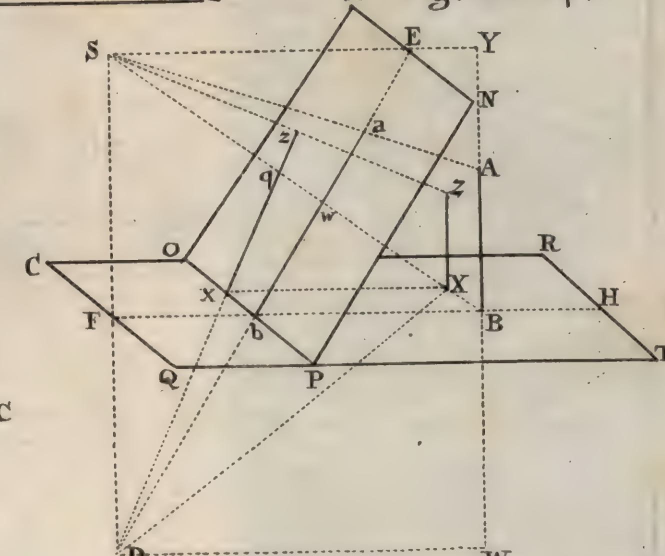
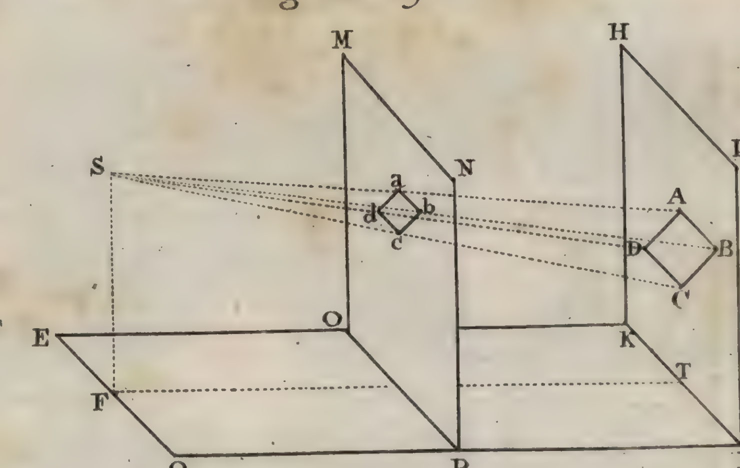


Fig. the 15th



THE

THEORY

OF

PERSPECTIVE.

By *James Hodgson*, F. R. S.

DEFINITIONS.

1. PERSPECTIVE is the art of describing on a plain surface the true representation or appearance of any given object, as seen from one determinate point for any given distance and height of the eye.

2. The perspective table, or plane, is that surface whereon the picture of the object is formed, according to the rules of perspective, as A B C F. *See Fig.* 1.

3. The geometrical or ground plane is that surface whereon the perspective table is supposed to stand, as G I K L.

4. The height of the eye is equal to the length of a perpendicular let fall from it to the ground plane, as E H.

5. The distance of the eye from the picture is equal to the length of a perpendicular drawn from the eye to the perspective table, as E D.

6. The common section of the perspective table with the ground plane is called the ground line or section, as A B.

7. The horizontal line is a line in the perspective table or picture, parallel to the section or ground line, and of the height of the eye above it, as M D N.

8. The principal ray is the line drawn from the eye perpendicular to the table, and is therefore equal to the distance of the eye from the table, as E D.

9. The diſtance of any point in the ground plane from the table is a perpendicular drawn from that point to the ground line or ſection, as Q T.

10. Direct parallel lines are ſuch as cut the ground line or ſection at right angles, as QT and S O.

11. Oblique parallel lines are ſuch as cut the ground line or ſection at oblique angles, as X T and Y Z.

12. Tranſverſe parallel lines are thoſe lines which cut the direct parallel lines at right angles, as P R and Q S.

13. Radial lines, or viſual rays, are ſuch as run up from points on the ground line, and unite in ſome certain point in the horizontal line, namely, either in the point of ſight or in an accidental point, as D T, D Z, D O.

14. The point of ſight is that point in the picture, which is found by drawing a perpendicular from the eye to the perſpective table or picture, in which all the direct rays concur, as the point D.

15. The accidental point is that point in the picture, where lines that fall obliquely on the ground line or ſection, but parallel amongſt themſelves, unite or concur as the direct rays do in the viſual point, as the point E. *See Fig.* 2.

16. The point of diſtance E is a point in the horizontal line of the table or picture removed as far diſtant from the viſual point D in the 2d figure, as the eye at E in the firſt figure is diſtant from the table or picture A B C F, namely, D E.

17. The point of incidence is a point in the ground line or ſection, where a perpendicular let fall from any point in the geometrical plane interſects it, as the point, T or Z. *See Fig.* 1.

18. The perſpective of any point is that point in the picture, where the viſual ray drawn from the eye at E to any point, as P, in the geometrical or ground plane, interſects the picture or table, as the point p.

19. The perſpective of a line is the common ſection of the table or picture, and the imaginary plane formed by an infinite number of rays flowing from the eye at E, and falling upon every point of the line R S to be repreſented, as the line r s.

20. The perſpective of any plane figure is the ſection of the cone or pyramid of rays, whoſe vertex is the eye, and baſis the figure propoſed, made by the plane of the table or picture.

21. The perſpective of any ſolid upon the table or picture is the aggregate of the perſpective of all the planes whereof the ſolid is compoſed.

22. The optic angle, under which any object appears, is formed by two lines drawn from the center of the eye, to the two extremities of the object, and here it is to be noted, that the moſt convenient diſtance of the eye, from the Extremities of the object ſhould be nearly equal to the longeſt dimenſion of the object, whether breadth or height.

For as the beauty of perſpective depends upon the point of diſtance, ſo the eye ought never to be placed too near the object, nor too far from it, but at a convenient diſtance; and never nearer to the object than one half of the largeſt dimenſion, for in this ſituation the viſual angle will be a right angle or 90 degrees; and as this is the largeſt angle that the eye can well diſcover at one caſt, ſo if it

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be made lefs than 45 degrees, the object will be too much contracted, and the vifual angle will be fo fmall that the returns in buildings would not be diftinguifhed, and the whole would appear confufed, and therefore when the vifual angle is about 60 degrees, which agrees with the above mentioned limitation, then the object is feen with the utmoft advantage, and confequently in all perfpective defigns they ought to come as near this fituation as poffible.

23. When the projection of any object is made on a plane parallel to the horizon by rays parallel and perpendicular to the fame plane, the reprefentation of the object in this cafe is called the *Ichnography* of the figure propofed, whence the bafe, bottom or platform, whereon a body or building is erected, is called the ichnography of that building, fo that to project the ichnographic reprefentation of any building is to draw the exact ground plot of the fame building; thus the geometric ichnography of a column is a circle, of a pedeftal is a fquare, *&c.*

24. When the projection is made on a plane perpendicular to the horizon by rays parallel and perpendicular to the plane upon which the object is reprefented, the reprefentation in this cafe is called the *Orthography* of the figure propofed; thus the upright front of any building or object is called the orthography of that object or building, fo that to draw the orthographic reprefentation of any object or building, is to draw the exact front of the object or building as it really is and appears to be.

25. But when the reprefentation or projection of any object is made by rays flowing from the feveral parts of the object, as the front, top or bottom, fide or fides, and uniting in one point where the eye is fuppofed to be placed, the Reprefentation of this object (upon a plane placed before the eye ftanding at right angles to the line drawn from the eye perpendicular to the object, and) formed by the interfection of the feveral rays with this plane, is called the *Schenography* of that object, fo that to draw the fchenographic projection or reprefentation of any object, is to draw the projection or reprefentation of the feveral parts of that object, as they will appear to the eye fituated at a convenient diftance from the object upon a plane placed perpendicular to the horizon, and in a proper fituation to receive the object; and how this is to be done, is the proper bufinefs of PERSPECTIVE.

AXIOMS.

1. The common interfection of two planes is a right line.

2. If two right lines meet in a point, a plane may pafs through them both.

3. If two or more right lines are parallel to each other, they will all be in the fame plane; that is, if a plane pafs through any two of thefe, it will pafs through all the reft.

4. If two or more parallel right lines are cut by another right line, there may be a plane that will pafs through them all.

5. If two parallel planes are interfected by another plane, their interfections will be parallel to each other.

 6. Lines

6. Lines parallel to the ſame right line, or to parallel lines, are parallel one to another; conceive the ſame of parallel planes.

7. Every point in any right line is in any plane that line is in.

8. A ſpace ſeen under a leſs angle appears leſs, and the ſame ſpace ſeen under a bigger angle appears bigger, and conſequently ſpaces ſeen under equal angles are equal amongſt themſelves.

Note, In this *Axiom* we ſuppoſe the ſpaces viewed ſtand at right angles to the axis or principal ray iſſuing directly from the eye, or, which is the ſame thing, that they are parallel to the perſpective table, for in other caſes, where the diameter of the object is inclined to the table, it will not hold good.

THEOREM I.

If the eye be placed any where between two parallel right lines, the farther theſe lines are produced from the ſight, the nearer they will ſeem to approach each other. See Fig. 3.

Let S repreſent the ſeat of the eye, E M and Q N the two given parallel lines, and S V the axis or principal ray, through the points A, C, and M, draw the lines A B, C D, and M N, perpendicular to the principal ray S V, and theſe lines will be parallel and equal to each other. Alſo from S, the point of ſight, let the rays S A, S B, S C, S D, S M, S N, be drawn.

Demonſtr. Becauſe the right angled triangles S Q B, S Q D, have the perpendicular S Q common to them both, but have the baſe Q D of the triangle S Q D, greater than the baſe Q B of the triangle S Q B, therefore the angle S D Q of the triangle S Q D, will, be leſs than the angle S B Q of the triangle S Q B; conſequently the angle P S D, which is equal to S D Q, will be leſs than the angle O S B, which is equal to S B Q, and conſequently the double of the angle P S D, or the angle C S D, will be leſſer than the double of the angle O S B, or the angle A S B, wherefore the line C D, will appear leſs than A B, by the 8th axiom, and conſequently the points C, and D, of the parallels E M, and Q N, will appear to the eye placed at S, nearer than the points A and B of the ſame parallels E M, and Q N. After the ſame manner it may be proved that the line M N, which is placed farther off from the eye at S, than the line C D, will appear leſs than C D, and conſequently the points M, and N, will ſeem to approach nearer to each other than the points C and D, which are nearer, and that the ſame line M N, being placed at a greater diſtance than S V, from the point of ſight, will appear leſſer, and conſequently the points M, and N, in the laſt Situation will ſeem to approach nearer to each other than in the preſent ſituation, and thus ſucceſſively, till at laſt the line M N will appear indefinitely ſmall, and the Points M and N will ſeem to come together.

Let us now ſuppoſe the eye, ſee *Figure* the 4th, placed above the plane paſſing through the given parallels, and let E M and Q N be the parallels themſelves.

From H, the middle point of the line E Q, erect the perpendicular H S, equal to the height of the eye above the plane, then will S be the place of the eye;

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from the point S draw the rays S E, S Q, S A, S B, *&c.* Now becauſe the angles S E A, and S Q B are right angles, the hypothenuſes, or rays S A, and S B, will be longer than the perpendiculars S E, and S Q; and inaſmuch as both triangles have the ſides S E, and S Q, equal to each other, it follows that the angle Q S E will be greater than the angle B S A, and conſequently the line A B will appear leſs than the line E Q, by axiom the 8th, and the points A, and B, will ſeem to be nearer to each other than the points E and Q, and by the ſame way of reaſoning it will follow, that the angle D S C will be leſs than the angle B S A, conſequently the line C D, will appear leſs than the line A B, and the Points C, and D, will ſeem to come nearer to each other than the points A, and B, *&c.* which was to be demonſtrated: And the ſame conſequences will follow if we ſuppoſe the point S placed below the given plane of parallels.

Let us now imagine a plane, as E M N Q, to paſs through the parallels E M, and Q N, it is manifeſt that to the eye placed in the plane itſelf, or above or below it, as in *Figure* the 4th, the two extremities M and N, which are fartheſt from the eye, will appear the neareſt to each other, and the farther they are produced the nearer they will approach, till at laſt being indefinitely produced, they will ſeem to meet in a point, and the diſtance will vaniſh.

And the ſame conſequence will follow in whatſoever ſituation the plane is placed, whether it be perpendicular to the horizon, or parallel to it, or inclined to it at any given angle.

Hence we ſee why rows of trees, of columns, of piláſters, why walls and the ſides of buildings contract themſelves and ſeem to grow narrower and narrower the farther they are extended from the eye.

Hence we ſee the reaſon why floors and pavements of buildings ſeem to riſe upwards towards the eye of the ſpectator, as is very viſible in long rooms or galleries, and why the cielings ſeem to ſink gradually downwards towards the eye, whilſt the ſides of the ſame building ſeem to come cloſer and cloſer, that the right Side ſeems to approach towards the left, and at the ſame time the left Side ſeems to approach towards the right Side, each dimenſion growing leſſer and leſſer, and approaching nearer and nearer, the longer the room is, till at laſt, if the length be indefinite, they will all vaniſh into the viſual point.

Hence we ſee the reaſon why the horizon appears higher than really it is, and that the convex ſurface of the ſea to an eye placed upon it appears curved and protuberant, and different from what it really is itſelf. And,

Hence we ſee alſo the reaſon why ſtatues and pictures placed at a conſiderable height above the eye, alſo why ornaments placed upon the tops of churches or other public buildings appear ſo much ſmaller than really they are, as well in breadth as in height, and hence are drawn rules for giving them their due proportion of magnitude according to the ſeveral ſtations alloted them, alſo for portraits drawn upon cielings or ſet up at any conſiderable height, and for a great variety of appearances too many here to enumerate.

Now inaſmuch as the viſible magnitude of the lines A O, C P, M V, ſee *Figure* the 3d, or their doubles, namely the lines A B, C D, M N, are as the tangents of the optic angles, A S O, C S P, M S V, to the ſeveral radii S O, S P,

S P, S V, or to their ſeveral diſtances from the eye, it follows that the viſible magnitude of any object increaſes or decreaſes in its various approaches to or removes from the eye in a reciprocal proportion to its ſeveral diſtances from it: And hence,

The viſible magnitude of any body being given, and its diſtance from the ſpectator, the true magnitude of the ſame body may be found; and on the contrary, the true or real magnitude of the object being given, its viſible magnitude at any given diſtance may be determined; and hence we are taught to find of what magnitude any object ought to be made to appear of a given bigneſs at a given diſtance.

Theſe laws extend to objects that are placed above or below the eye, as well as to objects that are placed upon the ſame horizontal plane with the eye, provided they be placed at the ſame diſtance from the eye; but if they are erected perpendicularly over the plane, their altitudes muſt be increaſed in the proportion of the difference of the tangent of the angle of elevation, and the tangent of the ſame angle of elevation increaſed by the optic angle of the figure when viewed upon the horizontal ſurface, and conſequently the higher any object is placed above the eye, the greater will be the difference between the tangents of the ſeveral angles of elevation, and the tangents of the ſame angles of elevation increaſed by the horizontal optic angle of the figure, and conſequently the greater muſt the real magnitude of the object be made to appear of the ſame bigneſs as if it was placed upon the ſame horizontal plane with the eye.

THEOREM II.

If any line in the object be parallel to the ground Line, its perſpective in the picture will be parallel to the ground Line alſo.

Let M N O P, ſee *Figure* the 5th, be the picture or perſpective table, S the place of the eye, and A B, parallel to the ground Line O P, the line to be drawn in perſpective.

From S, the place of the eye, to the extremities A and B of the line A B let the viſual rays S A, S B be drawn to cut the perſpective table in the points a and b. If theſe points a and b be joined together by the right line a b, I ſay this line a b in the table, which is the perſpective of the line A B, the given object, will be parallel to the ground Line O P.

Imagine a plane as K A B L, to paſs through the line A B, and to ſtand at right angles to the plane C D R Q, now becauſe the lines a b, and A B, are the common interſections of the parallel planes M N O P, and A B K L, by the viſual plane S A B, they will be parallel by the 5th axiom, but A B is parallel to the ground Line O P by hypotheſis, therefore its perſpective a b in the table will be parallel to the ground Line alſo, by the 6th axiom, which was to be proved: And inaſmuch as the ſame conſequence will follow in whatſoever place of the plane C D Q R, the line A B is ſeated, provided it be parallel to the ground Line A B, or at whatſoever diſtance from the eye the plane C D R Q is fixed, it follows that all lines that are parallel to the ground Line of any picture will, when drawn

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in perſpective, be parallel to each other and to the ground Line alſo. Again, becauſe the triangles S a b and S A B are ſimilar, S X, will be to S x, as A B to a b, but S X, is to S x, as S Z to S E; therefore, by a ſimilitude of ratios, a b will be to A B as S E is to S Z, that is, the length of the perſpective line in any picture is to the length of its original line, as the diſtance of the eye from the picture or perſpective table to the diſtance of the eye from the plane of the original object.

THEOREM III.

The perſpective of any line, that is perpendicular to the ground Line in the original plane, will, when drawn on the perſpective table, run up into the point of ſight.

Let S, ſee *Figure* the 6th, be the place of the eye, M N O P the perſpective table, M N the horizontal line, E the viſual point, O P the ground Line, and P R the given right line cutting the ground Line O P at right angles in the point of incidence, P, I ſay, if from P, the point of incidence, to E, the viſual point, the line E P be drawn in the picture, the perſpective of every point R in the given line P R will be found ſomewhere in the line E P, in the picture.

Produce the lines S E and R P to G and Q, and draw the line S Q.

Becauſe S G and Q R are parallel, and the line E P interſects them both in the points E and P, they will all be in the ſame plane S Q R G by the 4th axiom; and becauſe the point of ſight S, and the point R will be always found in this plane, the perſpective of the point R will always be found in the common interſection of this plane S Q R G, and the plane of the perſpective table M N O P that is in the line E P, and conſequently in the point r, where the ray S R drawn from the eye at S to the given point R in the line P R interſects the line E P drawn from the point of ſight E, to the point of incidence P, and conſequently if the point R were placed in the point P, the point P will be the perſpective at the point R, and the farther the point R is removed from the point P, the higher will its perſpective r be in the table, and the nearer will it approach to the viſual point E, till at laſt, being removed at an indefinite diſtance from the point of Incidence P, it will be projected in the viſual point E, and conſequently the line E P in the picture will be the perſpective of the right line P R, drawn perpendicular to the ground Line O P in the original plane, and indefinitely produced; which was to be proved.

After the ſame manner it may be proved that any other right line, as O D, indefinitely produced, that cuts the ground Line at right angles, will be repreſented in the perſpective table by the line E O, drawn from the point of ſight E in the table to O, the point of incidence or point where the line O D cuts the ground Line.

Whence it follows, that all ſtraight lines in the original plane, that cut the ground Line at right angles, will, when drawn upon the perſpective table, meet or interſect each other in the point of ſight.

THEOREM

THEOREM IV.

The perſpective of any line in the original plane, that cuts the ground Line at oblique or unequal angles, will be found in that right line that is drawn from the point of incidence P, *to the point A in the horizontal line of the table, which is found by drawing a line,* as S A, *from the eye at* S, *parallel to the original line* P R, *till it interſect the horizontal line of the table* M N. See *Fig.* 7.

Becauſe the lines S A and P R are parallel by hypotheſis, and A P interſects them in the points A and P, they will all be found in the ſame plane S A P R by the 4th axiom, and conſequently the perſpective of the point R will be found in the table in the point r, where the ray S R ſhall interſect the line A P, the common interſection of the plane S A P R, and the perſpective table M N O P, and if the line P R be indefinitely produced from the point of incidence P, that is, if the point R be removed at an indefinite diſtance from the point P, its perſpective will be in the point of the table at A, that is, the line A P will be the perſpective appearance upon the table of the line P R produced indefinitely.

After the ſame manner it may be proved, that any other ſtraight line, as O D, indefinitely produced will be projected on the perſpective table into the right line A O, drawn from the point of incidence O to the point found A, whence it follows, that all ſtraight lines that fall obliquely on the ground Line, yet if they be parallel amongſt themſelves, they will all unite or interſect each other in ſome point in the horizontal line, and that point is called the *accidental* point; and to find it,

From the eye point S, draw a line parallel to the original line upon the horizontal table, and where this line cuts the horizontal line it will give the accidental point.

Hence it follows, that if the eye be placed any where in the line A S, produced from A towards S, as far as you pleaſe, the ſame converging lines on the table will be the perſpectives of the ſame parallels in the ground Plane, and hence innumerable points of ſight may be aſſigned for viewing the ſame picture, and hence we have a ſolution of that perſpective paradox, That the ſame repreſentation of any original object will be projected on the table in the ſame lines, though the eye ſhould change its place and diſtance.

This propoſition is of very great uſe, and therefore ought to be thoroughly underſtood, it being the main and principal foundation of all the practice in perſpective and indeed the preceding or third *theorem* is nothing but a particular caſe of this general propoſition. Though I have given it a place by itſelf for order's ſake, ſince when the lines on the original plane fall at right angles upon the ground Line, the point of concourſe of theſe rays will be found by drawing a line from the eye perpendicular to the picture, and this will neceſſarily give the point of ſight to which all the lines, that fall perpendicularly upon the ground Line on the original plane muſt neceſſarily tend; as has been proved in the third *theorem.*

And

And inaſmuch as the line drawn from the eye to the point of diſtance upon the perſpective table muſt neceſſarily form an angle of 45 degrees, with the principal ray or the horizontal line, the containing ſides of the right angle being equal, it follows that the diagonals of all ſquares, one of whoſe ſides is parallel to the picture, and all other lines that form an angle of 45 degrees with the ground Line, will have the point of diſtance upon the table for their point of concourſe; and where, if produced upon the table, they will all center.

THEOREM V.

The projection or perſpective of any line, that is perpendicular to the horizontal or ground Plane, will on the picture or perſpective table be perpendicular to the ground Line.

Let N M O P, in *Fig.* 8. repreſent the perſpective table, C D K Q the horizontal or ground Plane, S the place of the eye, and A B the line to be projected, which in the preſent caſe is ſuppoſed to be perpendicular to the horizontal plane C D K Q: imagine the plane R T Z X to paſs through the line A B, and to be parallel to the picture M N O P; now becauſe S B A is another plane interſecting the two former planes, their common ſections, or the lines A B, a b, will be parallel to each other by the 5th axiom, but A B is perpendicular to the horizontal line X Z, therefore a b, if produced to G, will be perpendicular to the ground Line O P, which is parallel to the line X Z, the ground Line of the plane R T Z X. W. W. D.

And ſince the ſame conſequence will follow if the line A B be ſet upon any other point in the horizontal table, it follows that the perſpective repreſentation of all lines, that on the ground Plane are erected perpendicularly, will when projected on the perſpective table be perpendicular to the ground Line and parallel to each other. And inaſmuch as the line a b is to the line A B, as S b is to S B, that is, as S E is to S L, it follows that a b, the perſpective of A B, is to its original A B, as S E, the diſtance of the eye from the perſpective table, to S L, the diſtance of the eye from the plane of the original object.

Again, through the point a in the picture, the perſpective of the point A in the ground Plane, draw x z parallel to the ground Line O P, to cut the rays S X, S Z, in the points x and z, then will x z in the picture be the perſpective of the line X Z on the ground Plane, and becauſe, by the ſimilitude of the triangles s a x and S A X, it will be as A X is to a x, ſo is S A to s a, and ſo is S E to S L, and ſo is a E, to a S, and ſo is a b to A B; whence it follows that x a is to X A, as a b is to A B, that is, any perpendicular on the ground Plane is to its perſpective in the picture, as any parallel on the ground Plane is to its perſpective in the ſame picture, ſuppoſing the Perpendicular and Parallel at the ſame diſtance from the picture; whence it follows, that if the Perpendicular and the Parallel are both of the ſame length, their perſpectives in the picture will be of the ſame length alſo. And this is a property of no ſmall uſe in the practice of perſpective; for the

length of any original parallel or perpendicular being known, it will be eaſy by the help of a ſector to give any part of a ſcenographic projection its due dimenſions in any ſituation upon the table.

Again, if from any point S, in the line S F, conſidered as the place of the eye, rays, as S p B, S q A be drawn to the extremities of the perpendicular A B, becauſe A B is to p q, as S B is to S p, that is, as S B is to S b, that is, as A B is to a b, it follows that p q, and a b are equal: wherefore the diſtance of the object and the eye from the table, continuing the ſame, the perſpectives of the ſame perpendiculars, are equal to each other, whether the eye be placed at a greater or leſs height above the horizon.

PROBLEM I.

To find the ſeat in the perſpective table of any given point in the original or ground Plane, the height of the eye, its diſtance from the picture, and the diſtance of the original point from the table, being given.

Let N M O P, See *Fig.* 9. repreſent the table, S, the place of the eye, S F its height above the ground Plane C D K R, S E its diſtance from the picture, Q the original point in the horizontal plane C D K R, and A Q its diſtance from the perſpective table.

From S, draw the line S E, parallel to the horizon or perpendicular to the table, to cut the table in the point E, the viſual point in the table, and from Q, draw the line Q A perpendicular to the picture M N O P, to cut the ground Line in the point A, the point of incidence. Now if a plane as T S F Q, be imagined to paſs through the lines, S T, F Q, it will cut the perſpective table in the line E A, their common interſection; and in this line of the table will the perſpective of the point Q be found, and conſequently in the point q, the interſection of the diagonal S Q drawn from S, the point of ſight, to Q, the given point on the ground Plane. Let us now imagine the plane of the perſpective table to revolve about the line E A, the common interſection of the two planes till it coincide with the plane S T Q F, as in *Fig.* 10. then will the point Q in the horizontal table coincide with the point Q in the ground Line, the point S or ſeat of the eye, in the plane S F Q T, will coincide with the point S in the horizontal line of the perſpective table, and at the ſame diſtance from the viſual point E as it was from the perſpective table: In *Fig.* 9. in the like manner, the diſtance of the point Q, in the ground Line O P, will be as far diſtant from its point of incidence A, as it was in the horizontal plane from the ſame point A, for by this revolution of the plane of the perſpective table, the points S and Q revolve about the centers E and A, and conſequently always keep the ſame diſtance from them, but the line E A, the common interſection of the two planes M N O P, and S T Q F becoming now the axis about which the plane of the table revolves, remains the ſame immoveable, and conſequently the ſeat of the point Q in the perſpective table, remains in the ſame place as at firſt before the plane was ſuppoſed to revolve, and is therefore the true perſpective place upon the table; which being allowed, we ſhall have this general rule

For

For finding the ſeat in the perſpective table of any point in the horizontal table; (See *Fig.* 10.) Namely,

1. From Q, the given point in the horizontal table, draw the line Q A perpendicular to the ground Line, to cut in the point of incidence A.

2. Set off the diſtance A Q, of the point Q, in the horizontal Plane, from the ground Line O P, from its point of incidence A in the ſame ground Line, to Q.

3. From E, the point of ſight, to A, the point of incidence, draw the ray E A, and from S, the point of diſtance, to the point Q in the ground Line laſt found, draw the diagonal S Q, and where this interſects the ray E A, laſt drawn, as in the point q, it will give the perſpective in the table, of the given point Q in the ground Plane.

Now as every line is bounded by points, and every ſurface by lines, and every ſolid by ſurfaces; hence we are taught how to draw the repreſentation of any given object upon the perſpective table. And indeed the laws here laid down and demonſtrated are ſo general, that whoſoever underſtands them readily will ſee the reaſon of every ſtep taken in drawing the ſcenographic repreſentation of any original object upon any vertical perſpective table.

THEOREM VI.

If the perſpective table be inclined to the plane of the horizon at any given angle, the perſpective of any original line, that is parallel to the ground Line, will in the perſpective table be parallel to the ground Line alſo.

Let M N O P, in *Fig.* 11. repreſent the perſpective table, inclined to the horizontal plane C A B Q, at an angle equal to M O A; let S, be the place of the eye, and A B a line parallel to the ground Line P O, whoſe perſpective is to be drawn; from S, the eye, let the viſual rays S A, S B, be drawn to the extremities A and B of the given line A B, to cut the perſpective table in the points a and b; now if theſe points a and b are connected together by a right line a b, I ſay, this right line a b, which is the perſpective of the original line A B, will be parallel to the ground Line O P.

Imagine a plane as R A B T to paſs through the given line A B, and to be parallel to the plane of the table M N O P.

Now becauſe the lines a b, and A B, are the common interſections of the parallel planes M N O P, and R A B T, by the viſual plane S A B, they will be parallel to each other by the 5th axiom; but the original line A B is parallel to the ground Line O P, by hypotheſis, therefore a b, its perſpective in the table, will be parallel to the ſame ground Line O P alſo, by the 6th axiom. W. W. D.

Hence it follows that all lines whatſoever that upon the ground Plane are parallel to the ground Line, their perſpectives upon the picture will be parallel to the ground Line and to each other alſo.

THEOREM VII.

In any inclined plane, the perſpective of any line in the original plane, that, being produced, will cut the ground Line at oblique angles, will be found in the right line that is drawn from the point of incidence P, See *Fig.* 12. *to the point* A, *in the horizontal line of the table, which is found by drawing a line as* S A, *from the ſeat of the eye at* S, *parallel to the original line* P R, *till it interſect the horizontal line of the table* M N.

Becauſe the lines S A, and P R, are parallel by hypotheſis, and A P a right line interſecting them both, therefore a plane as S P R A will paſs through them all, and therefore the perſpective of the point R, will be found in the table in the point r, the interſection of the diagonal S R, with the line A P, the common interſection of the plane of the table M N O P, and the plane A S P R; conſequently, whereſoever the point R be taken, in the right line P R, its perſpective will be found ſomewhere in the line A P, and conſequently the line A P, in the table, will be the perſpective of the line P R indefinitely produced; ſo that in whatſoever part of the horizontal plane the line P R be taken, provided it always forms the ſame angle with the ground Line, its perſpective upon the table will be always found in that right line which connects its point of incidence P on the ground Line, with its accidental point A, in the horizontal line.

If the line P R cuts the ground Line at right angles, its parallel S A will interſect the table in the point of ſight E upon the table; wherefore in inclined planes, as well as vertical planes, as all lines that are perpendicular to the ground Line in the horizontal plane, when drawn on the perſpective table, do run up and unite in the point of ſight, ſo all other lines in the ground Plane that cut the ground Line when produced at unequal angles, will if they are parallel to each other, when projected on the perſpective table run up and unite in one common point; whence it follows, that the height of the eye and its diſtance from the inclined plane being known or given, the perſpective repreſentation of any original ground Plane is drawn on the inclined table by the ſame method, and after the ſame manner as it is done upon vertical tables. Let it therefore be required in

PROBLEM II.

To find the length of the principal ray intercepted between the point of ſight, and the ground Line; or which is the ſame thing, the height of the eye in the inclined table, and its diſtance from the table, the perpendicular height of the eye above the horizon, and the inclination of the perſpective table, being given.

Let O P, ſee *Fig.* 13. repreſent the ground Line, F Q C a line drawn at right angles to it, S the ſeat of the eye, S F its perpendicular height above the ground Plane, and Q E the inclined plane forming an angle with the horizontal plane equal to the angle E Q C.

From

From Q, the point of incidence of the line E Q, in the ground Line, draw A Q perpendicular to the ground Line, and through S, the ſeat of the eye, draw S A E, parallel to the line F C, to interſect the line Q E in E; then will E be the point of ſight in the inclined plane, Q E the height of the eye, and S E the ſpace between the viſual point E and the point of diſtance S, whence the perſpective of any ground plot may be drawn on that plane.

THEOREM VIII.

In any inclined plane, as M N O P, ſee *Fig.* 14. *if from* E, *the point of ſight, through the point* b, *where the baſe* F B, *of the eye's perpendicular height* S F, *cuts the ground Line of the table, a line as* E b, *be drawn, and produced till it cut* S F, *the line drawn from the eye at* S, *perpendicular to the horizontal plane* C Q O P, *produced downwards in the point* D, *I ſay, the perſpective of every line perpendicular to the horizontal plane, will be found in that right line in the table that is drawn from the point* D *through the point of incidence made by a perpendicular drawn from the baſe of the elevated line on the horizontal plane to the ground Line of the inclined table.*

Let M N O P be the inclined perſpective table, O P its ground Line where it interſects the ground Plane C R T Q, S the ſeat of the eye, S F its perpendicular height, E the point of ſight in the table, A B a line perpendicular to the ground Plane, whoſe point of incidence b, is coincident with the foot b of the principal ray E b drawn on the table; now if the lines S F and E b are produced till they interſect each other in the point D, I ſay, that if from this point D, through any other point of incidence, as x, in the ground Line, a right line as D x z be drawn, the perſpective of the line Z X erected perpendicularly over the horizontal plane, whoſe point of incidence in the ground Line is x, ſhall be found in this line z x in the table.

Becauſe the lines S F D and A B W are parallel by hypotheſis, a plane as S A B W D F will paſs through them, and becauſe the eye is ſeated in this plane in the point S, the perſpective of the line A B will be found upon the table in the line E D, the common interſection of the two planes, which line produced muſt neceſſarily cut the perpendicular S F, produced downwards in the point D, ſince they all lie in the ſame plane S Y W D.

Now if from this point D, a line as D x be drawn through x, the point of incidence of the line Z X, erected perpendicular over the horizontal plane C R T Q, I ſay, the perſpective of this line Z X will be found in the line D z x.

For becauſe the lines S D and Z X are parallel by hypotheſis, a plane as S Z X D will paſs through them both; and becauſe the eye is ſeated in this plane at S, the perſpective of the line Z X will be found on the table in the line x z, the common interſection of the two planes, which being produced muſt neceſſarily cut the line S D in the point D, the interſection of the ſame line S D with the plane of the inclined table produced, whence the perſpectives of the lines A B and Z X on the table, will be the lines a w, and z q, intercepted between the rays S A, S B, S X, and S Z flowing from the eye to the top and bottom of the given perpendiculars A B, and Z X.

And

And after the ſame manner may the perſpective of any other line elevated perpendicularly over the horizontal plane be drawn on the table.

For if we imagine a plane to paſs through the line S D, perpendicular to the horizontal plane indefinitely extended, and at the ſame time conceive this plane to revolve about the line S D as an axis, it will during the courſe of this revolution paſs through every line that ſtands perpendicular to the horizontal plane, and the ſucceſſive interſections of this plane with the plane of the table will be the ſucceſſive perſpectives of the ſeveral perpendiculars it ſhall happen to paſs through; and as all theſe lines muſt neceſſarily center in the immoveable point D, as being common to every ſituation of the revolving plane, it muſt neceſſarily follow, the eye remaining alſo immoveable, that the perſpective of every line that is perpendicular to the ground Plane, will be found in that line in the table which is produced by drawing a line from this point D, through the point of incidence in the ground Line, made by a perpendicular drawn from the baſe of the given elevated line to the ground Line of the inclined table; which was to be demonſtrated.

Hence and from the rules demonſtrated in *theorem* 6 and 7. the practice of drawing the perſpective of objects of any kind upon inclined tables is eaſily deduced.

By viewing the figure, it is evident that the greater the inclination of the plane, the leſſer will be the angle S D E, and the farther will the point D be removed from the horizontal plane C R T Q, till at laſt when the plane becomes vertical the point of interſection D vaniſhes, and the lines E b D and S F D become parallel, whence, as has been proved in the 5th *theorem*, it follows that all lines that are perpendicular to the horizontal plane will, when projected on the table, be perpendicular to the ground Line alſo.

Again, the farther the point of ſight S, is removed from the table, the greater will be the diſtance of the point of interſection D from the horizontal plane C R T Q, till at laſt the eye being ſuppoſed at an infinite diſtance, the line S F D will be removed at an infinite diſtance from the picture, alſo the point of interſection D will vaniſh, and the elevation of all lines perpendicular to the horizontal plane will become perpendiculars to the horizontal plane of the table, which is the foundation upon which the *Military* or *Bird's perſpective* is founded.

Again, the leſſer the inclination of the table M N O P, the nearer does the point of interſection D approach to the point F in the horizontal table, the foot of the eye's perpendicular, till at laſt when the inclined plane M N O P, coincides with the horizontal table C R T Q, the angle of incidence vaniſhes, and the point of concourſe D coincides with the point F; whence it follows,

That in all horizontal or optical projections, the perſpective of every line that is erected perpendicularly over the horizontal table, will be found in that line of the table which is produced by drawing a line from the foot of the eye perpendicular through the baſe of the elevated line; whence it follows, that the perſpective of all lines that ſtand perpendicular upon the horizontal plane, will, if produced, unite or center in one common point, namely the point where a line let fall perpendicularly ſhall interſect the horizontal table.

THEOREM IX.

If the plane of any original figure be parallel to the table, its perſpective will be ſimilar to its original, alike, aud alike ſituated.

Let S, ſee *Fig.* 15. be the ſeat of the eye, M N O P the table, H I K L the plane of the original figure A B C D.

I ſay, if the planes M N O P and H I K L are parallel, the perſpective appearance a b c d upon the table ſhall be ſimilar to its original A B C D.

For from S, the point of ſight, draw the rays S a A, S b B, S c C, and S d D.

Becauſe the planes MNOP, and HIKL, are parallel, S A B is a viſual plane interſecting them, therefore the common interſections a b, and A B will be parallel, therefore A B will be to a b as SB is to S b: And again, becauſe S B C is a viſual plane interſecting the ſame parallel planes, therefore their common interſections, namely the lines B C and bc will be parallel, therefore BC will be to bc, as the ſame ray S B is to the ray S b, wherefore by equality of ratios a b will be to b c as AB is to BC; after the ſame manner it may be proved that bc is to c d, as BC is to C D, and c d is to d a, as CD is to DA, whence the perſpective figure a b c d is ſimilar to its original ABCD; which was to be proved: Whence it follows, that the optical or horizontal perſpective of all plane figures that are parallel to the table, will be ſimilar to their originals; that is, that the perſpective of ſquare figures parallel to the horizontal or perſpective table, w'l on the table be ſquare, alſo the perſpectives of circles will be circles, of hexagons will be hexagons, *&c.*

Whence and from the laſt corollary of the preceding *theorem*, the reaſons of all the appearances in horizontal perſpective are manifeſt, and as all ſhadows are nothing elſe but horizontal projections of the ſeveral objects, the candle or luminous body ſupplying the place of the eye; hence it follows that every horizontal projection of any object elevated above the plane, is the projection of the ſhadow of the ſame object, and conſequently the rules given for forming of one will ſerve for forming the other. And inaſmuch as the immenſe diſtance of the ſun is infinite with regard to any terreſtrial object, hence it is that the rays that flow from the ſun to form the ſolar ſhadow are ſuppoſed to be parallel; and hence it is that every orthographic perſpective of any object elevated above the plane of the horizon, is the projection of the ſhadow of the ſame body, and conſequently in drawing of one, you draw the other alſo; and theſe ſeveral ſhadows, when drawn upon the ſcenographic table according to the rules of ſcenographic projection, will exhibit upon the ſame table the ſhadows of all objects drawn upon the picture.

Again, inaſmuch as the practice of horizontal perſpective proceeds after the ſame manner as does the practice of ſcenographic projections, ſo in *problem* the firſt, p ge the 10th,

If we ſuppoſe the eye in *figure* 10th in S, the point of diſtance in that caſe, and F Q to be the diſtance of the eye from the given object, the demonſtration for one will hold good for the other, and conſequently, in proving the operation in one, you prove the operation in the other alſo.

Though

Though my principal view in this tract has been to render the demonſtrations plain and conciſe, and the number of *Theorems* as few as poſſible, yet at the ſame time I have endeavoured to make them ſo general, that I may venture to ſay there is ſcarce any operation made uſe of in the practice of the ſeveral kinds of *Perſpective*, but what may be accounted for by ſome one or other of the preceding laws: This, together with the following treatiſe, which I look upon as one of the beſt practical books of its ſize that has appeared in the *Engliſh* language, will, I hope, make the whole as compleat and uſeful a piece as can be compriſed in ſuch a volume as this is.

PRACTICAL PERSPECTIVE.

PART I.

SHEWING THE

DEFINITIONS

AND

PRINCIPLES

OF

PERSPECTIVE.

Definitions, Names, *and* Terms *of the* Points, Lines *and* Figures *used in the following Work.*

A Point is that which is conceived to have no parts; such as A, *Fig.* 1. There are three kinds of points used in perspective, called *points of sight* or *view*, *points of distance*, and *contingent* or *accidental points*.

A Line is a length without breadth; such is A B, *Fig.* 2. There are five principal lines used in perspective, namely, 1. The *line of the base*, called also the *line of the plane*, or the *terrestrial line*, as C D, *Fig.* 3. 2d. The *perpendicular* or *plumb line*, which, falling on another, makes the angles * on either side equal: such angles are said to be *right* ones, and the line so falling on the other called a *perpendicular* thereto. Thus, in *Fig.* 3. A B and E F, falling on C D, and making right angles in B and G, is a perpendicular thereto. 3. The *parallel lines*, which, being continued on the same plane to infinity, never meet; as the lines N and O, *Fig.* 6. The *horizontal line* is no more than a line drawn parallel to the *terrestrial lines*; as shall be shown in its place. 4. The *diagonal line*, which is that drawn across a figure, from one angle to another; such is K L, *Fig.* 10. 5. The *occult line*, which is either drawn in dots, or dry, and is supposed not to appear when the work is finished; such is O N, *Fig.* 2.

A right Angle we have already said to be that formed by a perpendicular. It is here represented apart, by E F G, *Fig.* 4. to shew what it is the more distinctly. There are two other kinds of angles, which comprise all those that are not right ones: the first, called *obtuse*, are such as are greater than a right angle: as H L M, *Fig.* 5. The other, *acute*, are less than a right angle; such is H I K in the same figure.

A Term is the extremity or bounds of any thing: thus the points A and B, *Fig.* 2. are the *terms* of the line A B.

A Figure is comprehended under one or more terms; thus 7, 8, 9, 13, *&c.* are *figures*.

A Square has its four sides equal, and its four angles right; such is A B C D *Fig.* 7.

A Parallelogram, or long square, has its four angles right, but not its sides equal; such is C D E F, *Fig.* 8.

An Equilateral Triangle consists of three equal sides; as G H I, *Fig.* 9.

The Section or Intersection of two lines is when they run across, or cut each other in a point, as in *Fig.* 11. where A B and C D cut or *intersect* in E.

A Curve Line is that which goes indirectly, or about, from one point to another; such is L M, *Fig.* 12.

A Circle is a plain figure, comprehended under one single line, called the *circumference*, to which all lines drawn from the center are equal; such is B C D, in *Fig.* 13. And the point A in the middle thereof is called the *center*.

The Diameter of a circle is a right line B C, passing through the center A, and dividing the circle into two equal parts.

A Radius is any right line drawn from the center of a circle to its circumference, as the line A D.

An Arch is any part of the circumference, as B D C.

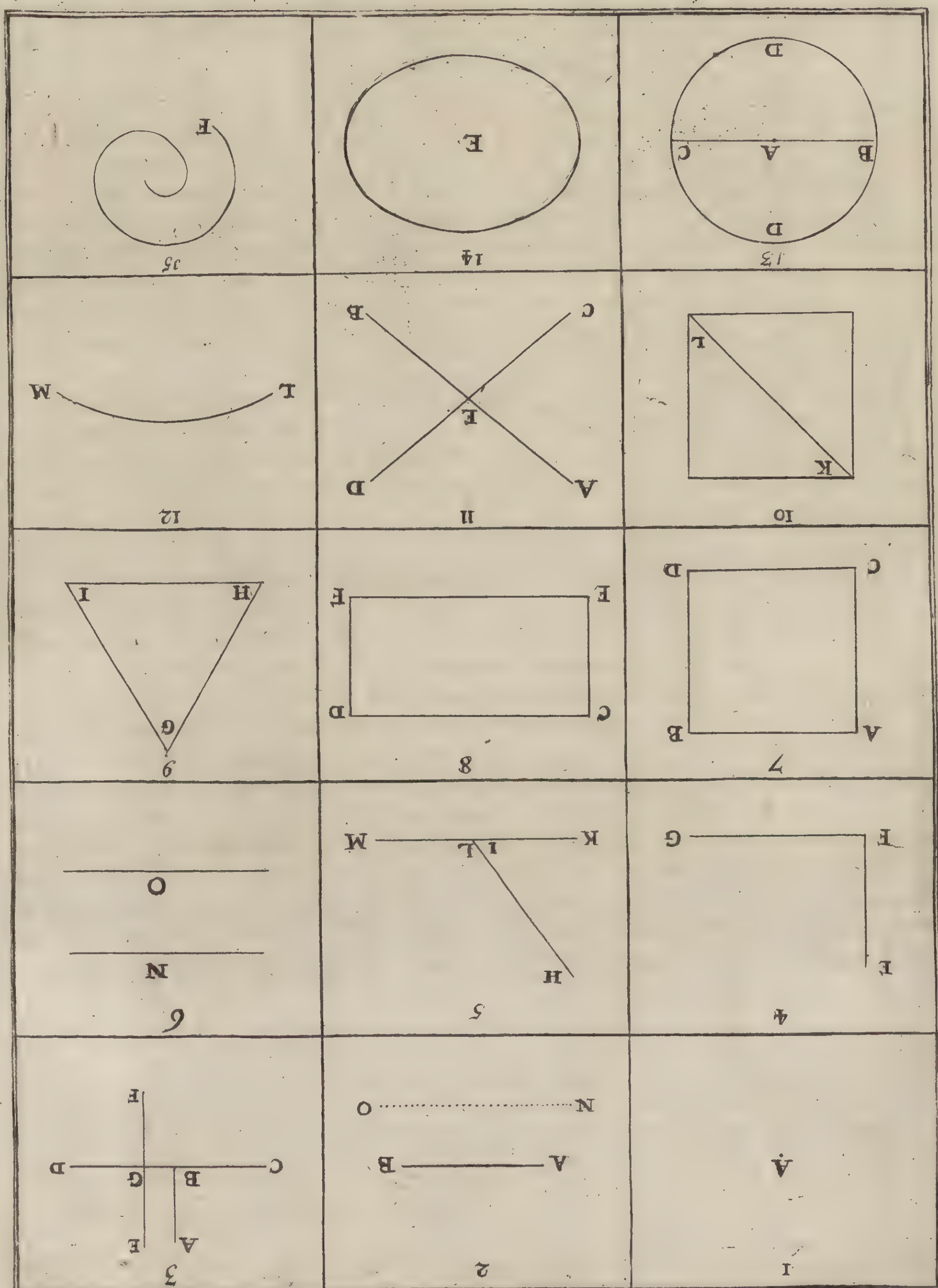
The Chord of an arch is a right line drawn from one end of an arch to the other; as B C is the chord of the arch B D C, and B D is the chord of the arch B D.

Every Arch of a circle is measured by its chord; thus B D is the measure of the arch BD, and B C, the greatest of all chords, measures the arch B D C.

An Oval, or Ellipsis, is an oblong figure, comprehended under one crooked, regular, but not circular, line; such is E, *Fig.* 14.

A spiral, or Volute, is a line found by a revolution about one or two centers; such is F, *Fig.* 15.

* An angle, the aperture or inclination of two right lines meeting in the same plane, is usually expressed by three letters; the middle letter shews the angle, and the other two the lines that make the angle; as in *Fig.* 5. H L M is the obtuse angle L, and H L K, is the acute angle L.



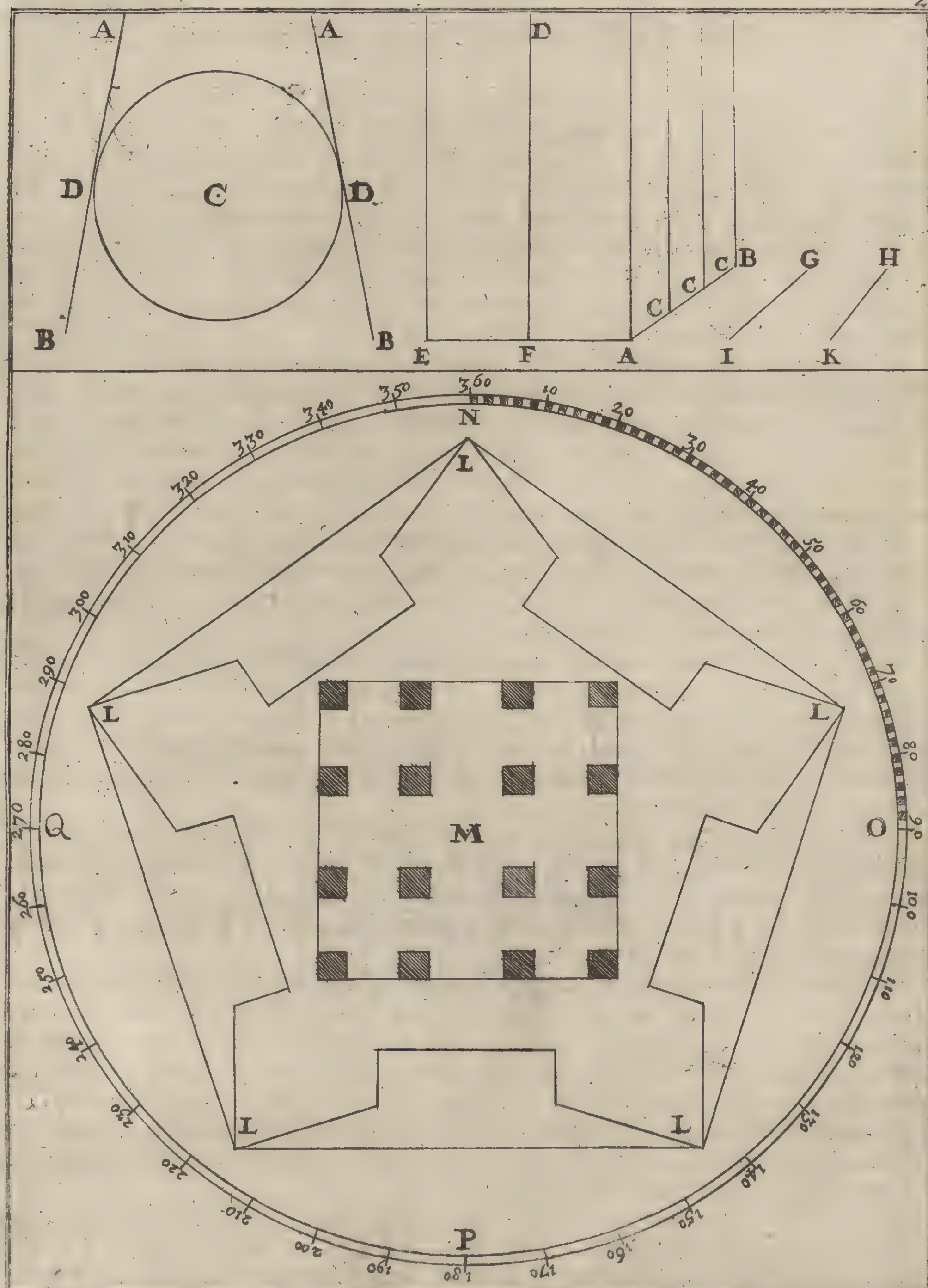
SEQUEL *of the* Definitions, Names, *and* Terms.

A TANGENT is a line, which being produced only touches or razes an object, figure, or line, without cutting it: thus the lines A B are *tangents* to the circle C, in the points D D. I here add two kinds of lines, which have the ſame denominations as the former, and yet have different effects, on account of the point of view: for the angle E A B is to be eſteemed a right angle, and all the lines C C C, *&c.* to be eſteemed as perpendiculars to the plane, as D F is; and the lines A B, G I, and H K, as perpendiculars to the the terreſtrial line. All the lines drawn to the point of ſight, whether from above or below, or from either ſide, are called RAYS, or VISUAL RAYS.

A PLAN, ICHNOGRAPHY, or GROUND-PLAT, is a firſt draught or deſign of a work, repreſenting the traces or paths of its foundation on the ground, ſo as to exhibit the extent, diviſion, and diſtribution of its various parts, in their ſeveral magnitudes and proportions, reſpectively, at one view. This is what I have repreſented in L and M.

A POLYGON is a figure containing ſeveral angles; as L.

A DEGREE is a ſmall arch or portion of a circle. Every circle is ſuppoſed to contain 360 degrees, and an arch is eſtimated by the number of thoſe degrees it takes up. Thus N O is an arch of 90 degrees. Aſtronomers ſubdivide each degree into 60 minutes, and each minute into 60 ſeconds, *&c.* But ſuch ſubdiviſion has no place here. It is enough we know that degrees are thoſe little diviſions in the circle N O P Q, whereby all angles are meaſured. To know their quantity, an arch is deſcribed, having its center in the point of the angle. From them we derive an eaſy method of making all ſorts of polygons, namely, by dividing 360 by the number of angles the figures are to conſiſt of. Thus, for inſtance, if I would make a ſquare, divide 360 by 4, the quotient is 90, which gives the right angle N M O: and ſo for the reſt. Such as are unacquainted with arithmetic, will find geometrical methods of doing the ſame in *plate* IV.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Methods of describing the Lines *and* Figures.

1. TO *raise perpendiculars:* If it be in the middle of a line that a perpendicular is required, open the compasses to more than half the length of the line, and setting one foot in the point A, *Fig.* 1. with the other strike little arches both above and below, as F and F: Do the like at the point E, and the two intersections of those arches will give a perpendicular to the line A E.

2. *If the line be at the top or bottom of a draught or paper*, so that arches cannot be struck both above and underneath, divide the line into two, to get the point G, *Fig.* 2. and from the two extremes of the line, make arches intersecting each other in H; then draw a line from H to G.

3. *To raise a perpendicular at the end of a line*, as at the point I of the line I K, *Fig.* 3. there are divers methods: The first is that already delivered. But where room is wanting, one leg of the compasses is to be set in the point I, and with the other a large portion of a circle L M is to be struck, and the compasses, thus open, to be set on the point M, and with the other leg the circle to be cut in the point N, half the arch M N being set off from M towards O, gives the right angle O I K. Or, without seeking for half the arch M N, from the point N, describe an arch P Q; then, laying a ruler over the points M and N, draw a line, cutting the arch P Q in the point P, and raise a line from I to P; which is the perpendicular required.

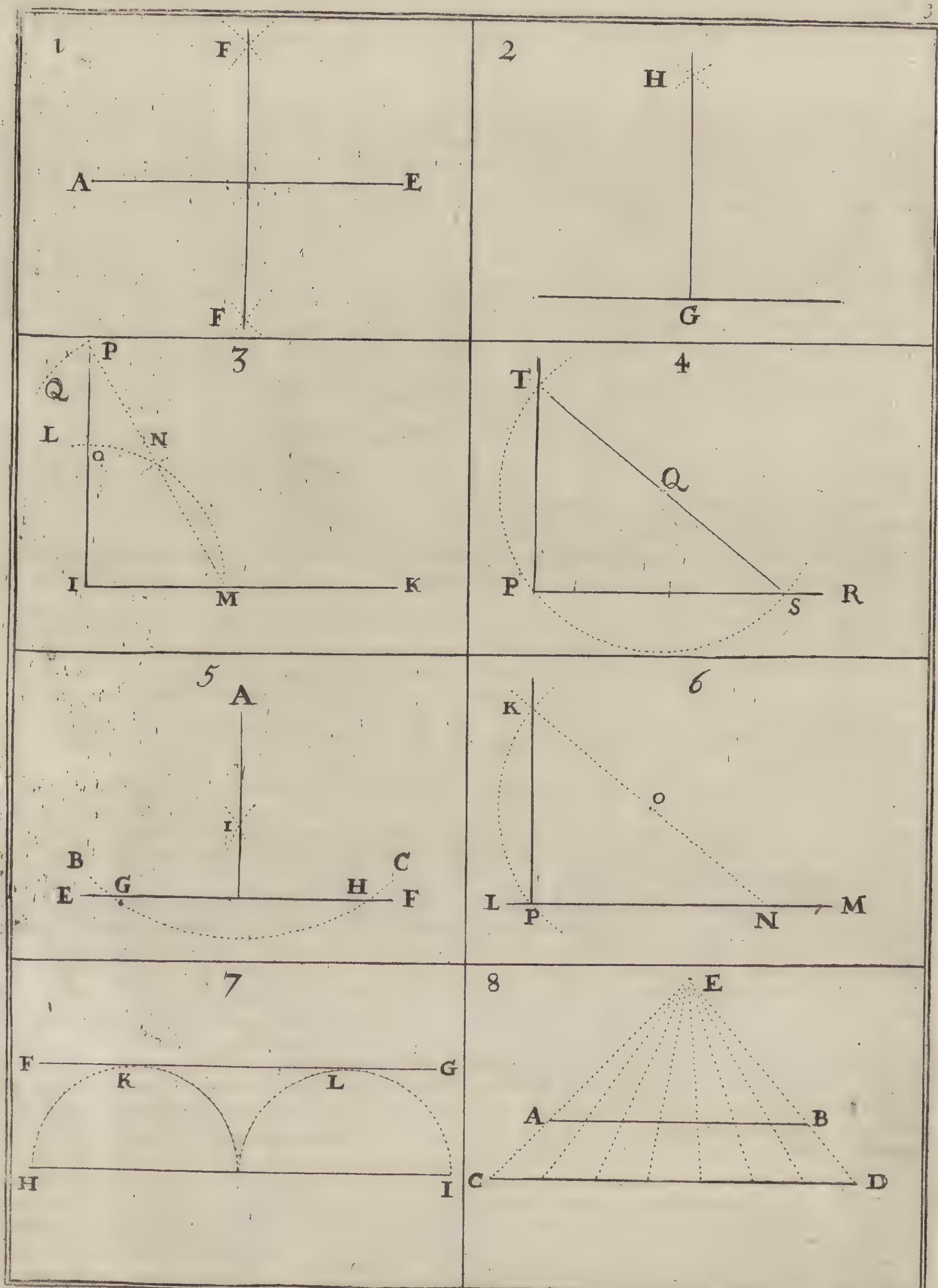
4. *Or thus:* If you would raise a perpendicular from the point P, *Fig.* 4. take a point at pleasure over the line P S, as the point Q, and from this point describe a circle passing through the point P, and cutting the line P S in some place, as S; then from S draw a line through Q to the circumference of the circle T, and the point T gives the extreme of the perpendicular T P. A just square shortens all these operations.

5. *To let fall a perpendicular* from a given point: From the point, as A, *Fig.* 5. describe the arch B C, cutting the given line E F in the points G H, from which points describe two little arches above or below, cutting each other in the point I; then, from the point A let fall a line through I to the line E F, and it will be the perpendicular of the given point.

6. *From a point given at the end of a line, to let fall a perpendicular:* Suppose the given point K, and the line L M, *Fig.* 6. from K draw a traverse line at pleasure, cutting the line L M in some point, as N; divide the line K N into two equal parts, and from the middle point O, draw an arch through K; and from the point P, where the arch intersects the line L M, draw the perpendicular K P.

7. *A parallel line*, if truly drawn, will be a tangent to semi-circles drawn from points assumed in the other line: thus F G, *Fig.* 7. is parallel to H I, because it only touches or razes the semi-circles L and K.

8. *To divide a line into equal parts:* Suppose the line be A B, draw another parallel thereto, either above or below it, as C D; and on this last, which is either to be greater or less than that to be divided, set off as many parts as A B is to be divided into, for example, into seven; from the first and last of these divisions draw lines through the extremes of A B, intersecting each other in some point, as E; from which point drawing lines to all the divisions of the line C D, the line A B will be divided into seven equal parts.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METHODS of Describing *the Figures.*

1. A *Line* as A B, *Fig.* 1. *being given to form a ſquare on,* ſet one foot of the compaſſes in the point A, and extending the other the length A B, deſcribe the arch B C ; then from the point B deſcribe another arch A D, interſecting the former in E, and from E ſet off half the arch E A, or E B outwardly, to D and C ; to which points drawing lines from A, B, *&c.* the ſquare is formed.

Or thus : upon the given line A B erect a perpendicular A C equal to A B ; then, taking the length A B in your compaſſes, ſet one foot in B, and with the other deſcribe an arch : the like being done from the point C, the interſection of the two arches will be the point D, which gives the ſquare ABCD.

2. *To deſcribe a parallelogram,* or *long ſquare,* on the term E, of the given line E F. Erect a perpendicular either greater or leſs than the ſame, as E G ; then taking E G in your compaſſes, ſet one foot in F, and with the other deſcribe an arch ; take alſo E F in your compaſſes, and ſetting one foot in G, deſcribe a ſecond arch, cutting the former in H : this will give you the parallelogram required.

Of Circular Polygons, *which are Figures of ſeveral angles inſcribed in circles.*

3. *To deſcribe an equilateral triangle :* The compaſſes being open to the radius of the circle, ſet one foot in the point A, deſcribe the arch D E, and draw a right line D E, which will be the ſide of the triangle D E F.

4. *For a ſquare,* draw two diameters at right angles, and join their extremes ; thus you will have the ſquare A B C D.

5. *For a pentagon,* or *five-angle,* draw two diameters, and take D G, half the ſemi-diameter D I, and from the point G, with the interval G A, deſcribe the arch A H ; the chord of which is the ſide of the pentagon.

6. *For the Hexagon,* or *Six-Angle,* the ſemi-diameter is the ſide of the hexagon.

7. *For the Heptagon,* or *Sept-Angle,* take half a ſide of the equilateral triangle.

8. *For the Octogon,* or *Eight-Angle,* take half a quadrant of the circle.

9. *For the Enneagon,* or *Nine-Angle,* take two thirds of the ſemi-diameter for the ſide ; as E B.

10. *For the Decagon,* or *Ten-Angle,* divide the ſemidiameter into two in the point G, and from G, with the interval G A, deſcribe an arch A B ; the part of the diameter B C will be the ſide of the decagon.

11. *For the Undecagon,* or *Eleven-Angle,* draw two diameters at right angles, and from the point A, with the interval of a ſemi-diameter, deſcribe an arch B C ; then from the point of interſection C, draw a line to E ; the portion C D will be the ſide of the undecagon.

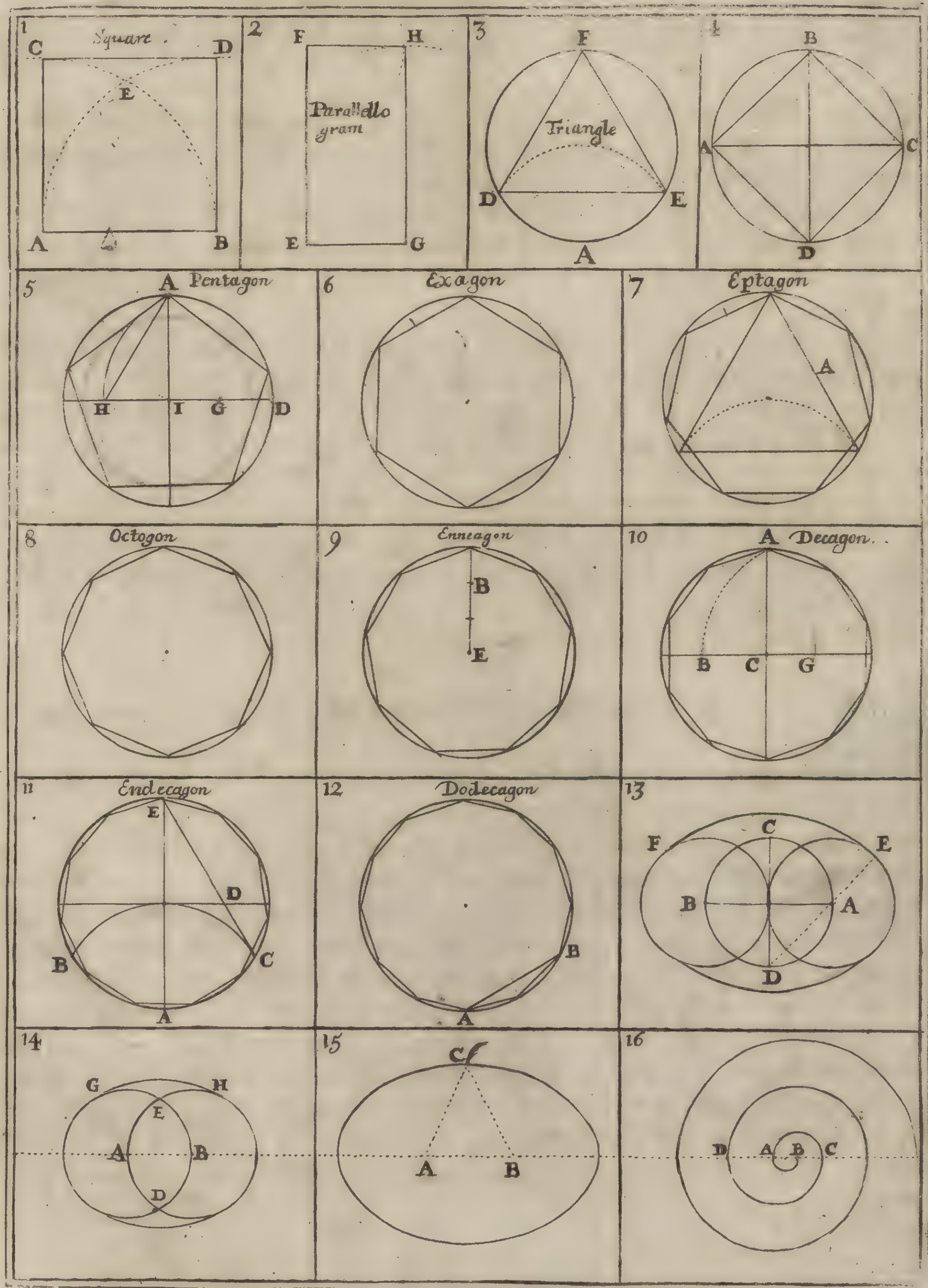
12. *Dodecagon,* or *Twelve-Angle,* divide the arch of a hexagon, A B, into two equal parts ; the chord of the moiety will be the ſide.

13. *An Oval* is formed divers ways ; in all which the figure is either a compound of ſeveral portions of circles, or it is one line drawn from two centers. The moſt uſual methods are theſe : having deſcribed a circle, and drawn two diameters therein, as A B C D, from the points A B we draw two other circles equal with the firſt ; then from the point D we draw a line through the center of the laſt circle to the circumference E : this done, ſetting one foot of the compaſſes in D, and with the other taking the interval E, we deſcribe an arch E F. The like being done on the other ſide, the oval is formed.

14. *For a rounder Oval,* draw a ſingle line, and from A, as a center, deſcribe a circle, the interſection whereof with the right line in the point B, will be the center of another circle. Now, to form the oval, take in your compaſſes the whole diameter of one of the circles, as from A to F, and in one of the interſections of the circles, as D, ſetting one foot of the compaſſes, with the other draw the arch G H : the like do from the point E.

15. *Otherwiſe* we have an eaſier and a more uſeful manner of deſcribing ovals than any of the preceding ones ; the ſame rule ſerving for all forms, long, narrow, broad, ſhort, *&c.* thus : ſet two nails or pins in a right line A B, to ſerve as a center, and about theſe tie a thread of the length and width of the oval required, as A B C ; hold the thread tight with a pen or pencil, and turn it about till you arrive where you began. If you require it a long one, ſet the centers the farther apart ; and obſerve the contrary for a ſhort one ; for if the nails ſtand cloſe together, the figure will be a circle.

16. *For a Spiral,* or *Volute,* take two points in a line A B ; the points to ſerve, one after another, as centers, For inſtance, having drawn the ſemi-circle A B, ſet one foot of the compaſſes in B, and open the other to the length B A, and deſcribe a ſemi-circle A C ; then ſetting one foot in A, take the interval A C, and draw the ſemi-circle C D ; and this continuing as long as you pleaſe, ſtill ſhifting centers. *Vignola* gives us another method.



1 Square C D E A B
2 F H Parallello gram E G
3 F Triangle D E A
4 B A C D
5 A Pentagon H I G D
6 Exagon
7 Eptagon A
8 Octogon
9 Enneagon B E
10 A Decagon B C G
11 Endecagon E D B C A
12 Dodecagon B A
13 C F E B A D
14 G H E A B D
15 Cf A B
16 D A B C

Of the VISUAL RAYS.

IF *an object be a single point*, it sends only one visual ray to the center of the eye; and that ray is called the *axis*, or *central ray*, as being the most vivid of all rays: such is A B.

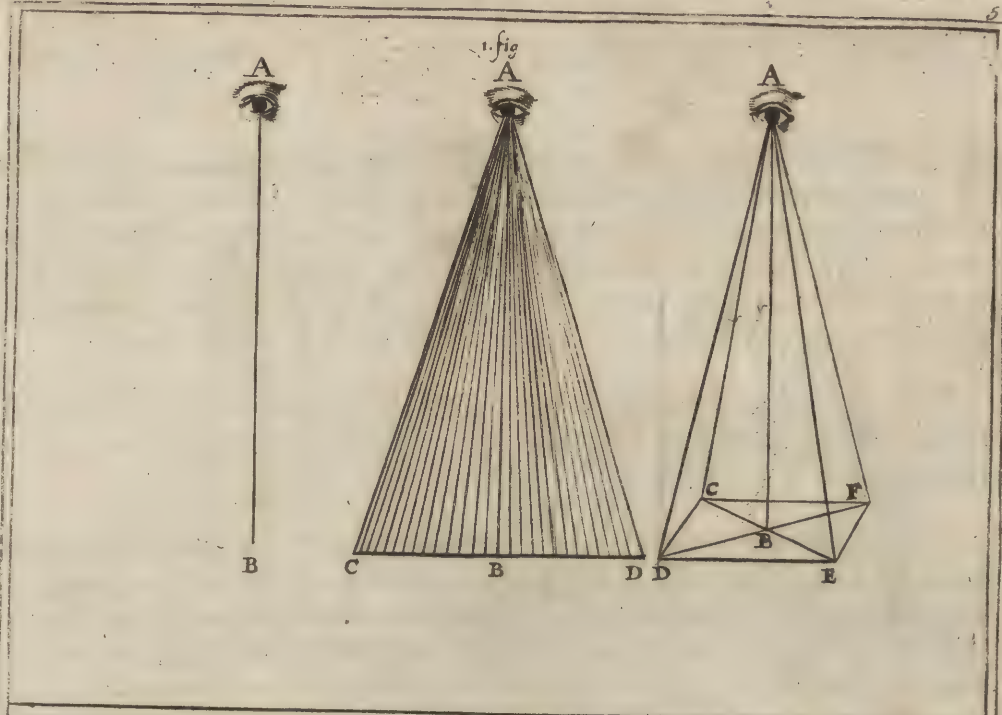
If the object be a right line, the visual rays form a triangle, as C A D, whose base is the line CD, and sides the two extreme rays A D and A C; A B is the central ray. If the line was seen end-wise, it would appear as a point.

If the object be a surface, whether plane or spherical, the visual rays will make a pyramid, whose basis is the object C D E F, and its vertex the eye A. The rest of the pyramid consists of visual rays; of which the central A B is the strongest, the others growing weaker, as they are removed farther therefrom, though they still retain a competent strength, till they make a right angled triangle. Such as go beyond this, become so feeble, that they appear very confusedly, so that to have distinct vision, the extreme under which an object is comprehended, must, at most, subtend a right angle in the eye. If the surface was viewed edge-wise, it would appear no more than a line.

Why a Piece of Perspective *is seen better with one Eye than with two.*

Some hold that all objects appear better with one than both eyes; alledging, that the sight is rendered more penetrating by the visual rays of the shut eye being determined to the other; inasmuch as all powers become more vigorous when united, than when dispersed. Accordingly, say they, one of the eyes being closed, the whole visive virtue before diffused through both, is now supposed to be collected into one; and this reinforcement must necessarily render it stronger, more piercing, *&c.* than both.

Be this as it will, it is certain, we see a piece of perspective with one eye better than with both. The reason is, that the central ray, in this case, is directed to the point of sight where all the radials of the piece unite and center, which is what shews a picture in its highest perfection. It is for this reason that we do not say, *the points of the eyes*, but, *the point of the eye*, as insinuating, that perspective is most pleasing when viewed by a single eye.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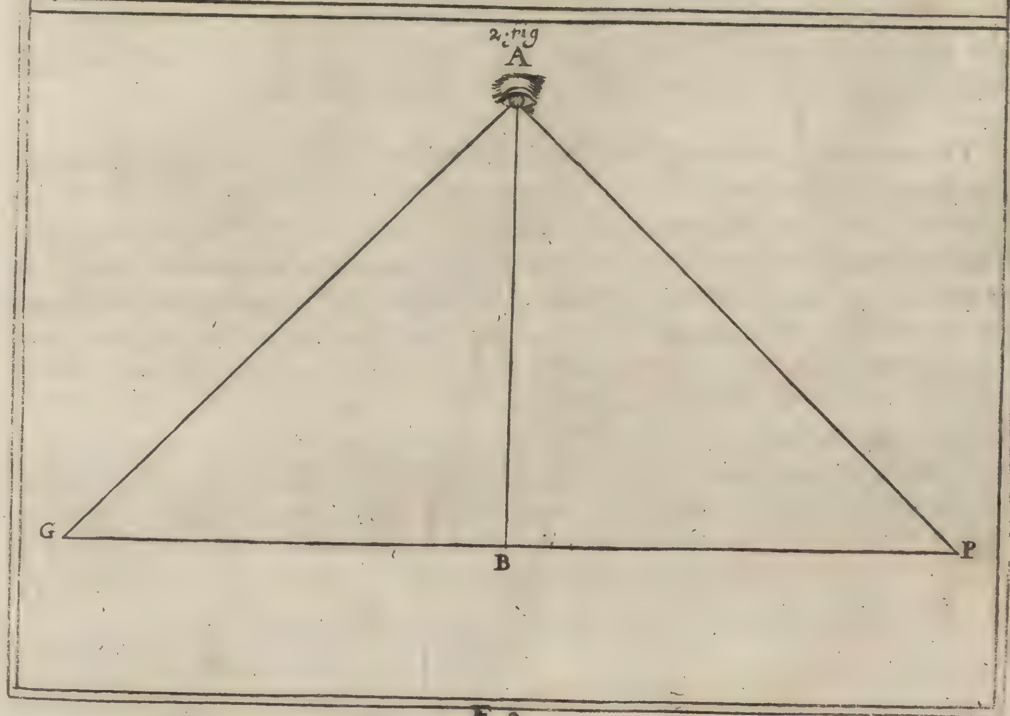
2. fig
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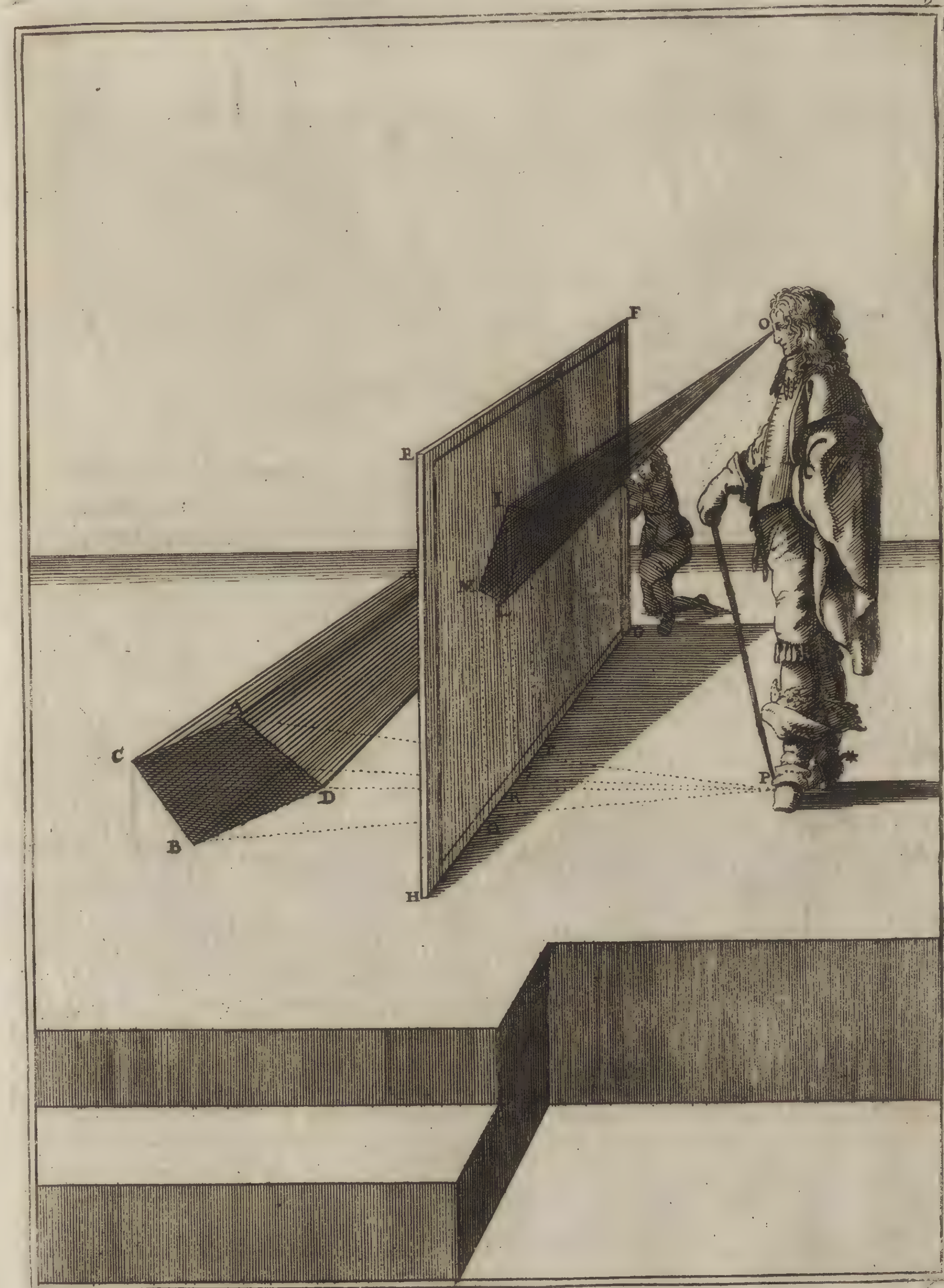
First DEFINITION.

PERSPECTIVE is the art of reprefenting objects feen through fome tranfparent medium, which the vifual rays penetrate in paffing from the feveral points of the object to the eye. Accordingly, whatever is feen through any thing, as through air, water, clouds, glafs, and the like, may be faid to be feen in *Perfpective*. And fince we fee nothing but through thofe mediums, it is certain all we fee is in perfpective.

The end of perfpective is to exhibit objects upon a plane, fituate between the eye and them, for example, on the plane E F G H, to reprefent the objects A B C D, in the points I K L M.

The better to conceive this, fuppofe an object A B C D on the ground, and a fpectator's eye in O, if a tranfparent body E F G H be placed between the two, the interfections of the vifual rays with the perpendiculars Q R S T, will give the figure I K L M, fuch as the object appears on that plane. Perfpective, therefore, confifts altogether in the interfections of lines: whence it is, that *Marolois* always calls any thing put in perfpective, the *appearance of the fection*; fince the plane E F G H cuts the vifual pyramid A C B D and O, and gives I K L M for its fection.

The reafon of thefe fections is, that one fingle line determines nothing; but there are two required to cut one another, to give a point. Now, as it is evident, that between our eye and an object there is always a right line, or ray, that can never be wanting: but to get the other, which is to cut it, it is neceffary we conceive, that from our foot as a center, there are a number of lines, or rays, continually flowing to the angles of the objects we fee; as from P to the angles A B C D: all which rays being cut by fome tranfparent plane, as EFGH, the rays PB, PA, PC, PD, which before were horizontal, are now erected and become perpendicular: P B, for inftance, becoming Q M, P D becoming R L, &c. For if they continued horizontal, the vifual rays would never interfect them, till they both met in the object itfelf. It is for this reafon we always fuppofe a plane, which, reflecting the rays, gives them an occafion of interfecting, and fo of finding the points to form the appearances of objects.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Second DEFINITION.

ICHNOGRAPHY is the plan of any work, on the view of it, cut off by a plane parallel to the horizon, juſt at the baſe or bottom of it. A geometrical plan, as that in page 2, exhibits the various parts in their juſt proportions, and their different magnitudes may be aſcertained by the uſe of a ſcale. A perſpective plan, is one conducted and exhibited by degradations and diminutions according to the rules of perſpective; thus A B C D is the *Ichnography*, or perſpective plan, of a ſquare body.

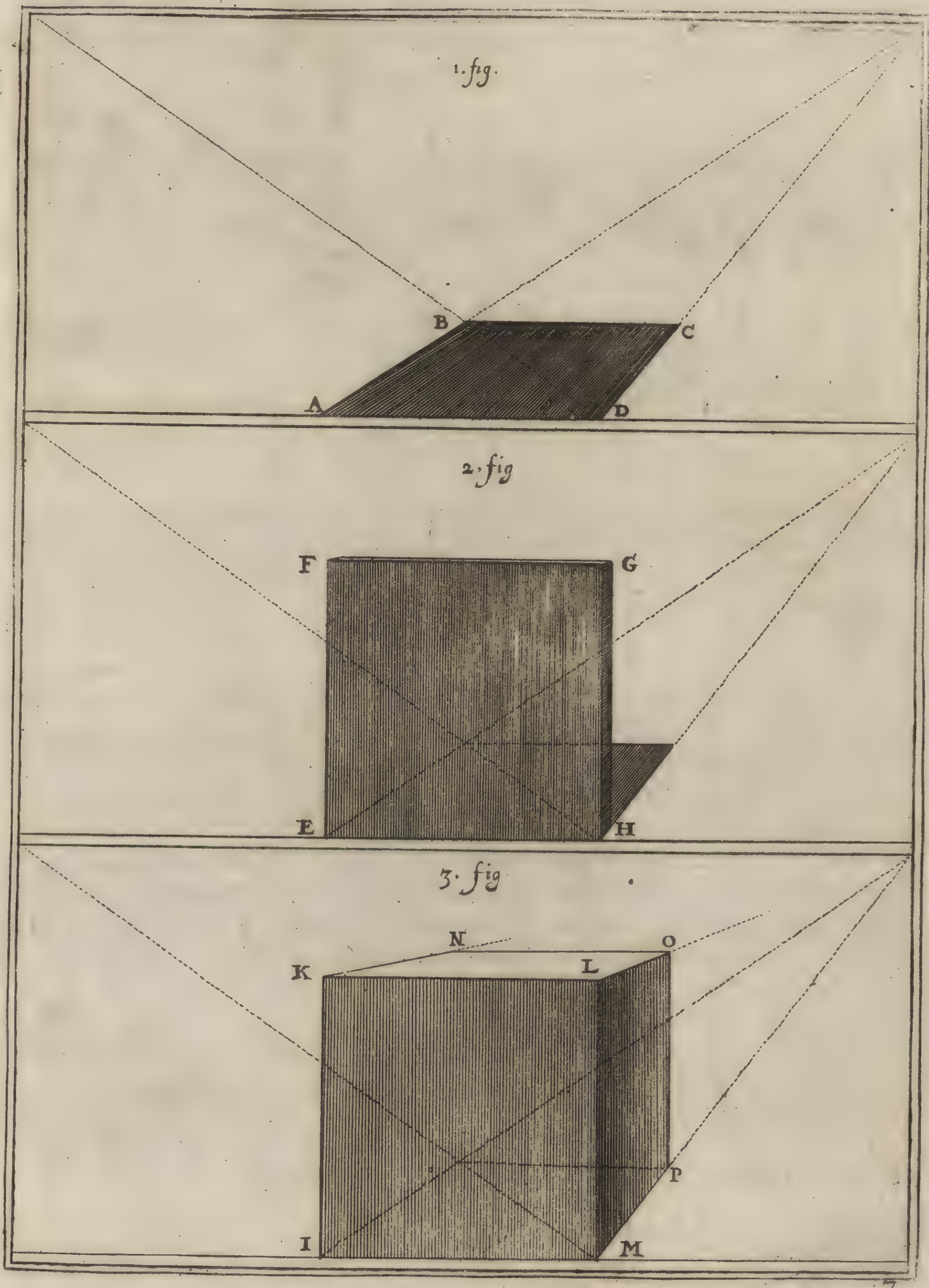
Third DEFINITION.

ORTHOGRAPHY is the delineation of the front or fore-ſide of an object, as an houſe or a cube, *&c.* Or the elevation of any object, as a houſe or a cube, *&c.* directly oppoſite to the eye. Thus E F G H is the *orthography*, or fore-part, of a cube. As the *ichnography* repreſents the plan, the *orthography* repreſents the ſide oppoſite to the eye.

Fourth DEFINITION.

SCENOGRAPHY exhibits the object quite raiſed, and perfect, in the front, top, and that ſide which is viſible from the ſituation of the ſpectator's eye. Thus I K L M N O P is a *Scenography*, or perfect cube. This is the whole object compleat, and comprehends the plan and front as parts

The ſum of what has been defined is, the *Ichnography* of a building, *&c.* repreſents the plan or ground work of the building. The *Orthography*, the front or fore-right plane. And the *Scenography*, the whole building, front, ſides, height and all. Preferring the more familiar terms, for the future, I ſhall call the *Ichnography* PLAN, the *Orthography* FRONT, and the *Scenography* ELEVATION.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Why Objects *appear the nearer each other, as they are more remote from the Eye.*

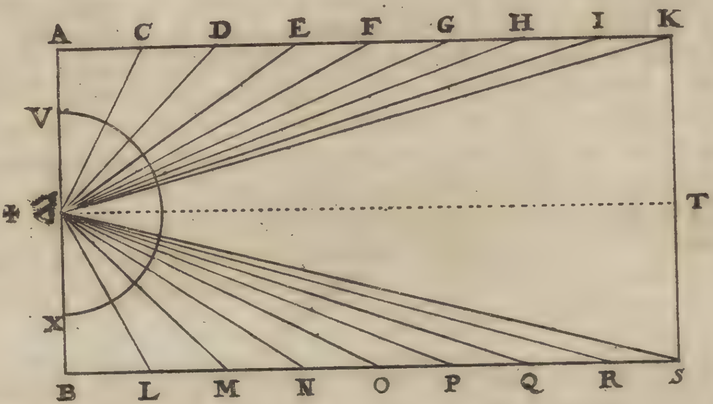
THIS figure may help to ſolve a queſtion of ſome difficulty. Suppoſe a ſpectator's eye in the middle of a line at +, it is evident, that if it would ſee the two extremes thereof, A and B, it muſt take in a ſemi-circle V X, whoſe center is in the eye itſelf, and whoſe central ray is the line + T. By taking in this ſemi-circle, it will perceive the objects on either ſide, and in ſuch manner, as that thoſe fartheſt off from A will appear to approach towards the center T, and thoſe on the ſide B ſeem to approach likewiſe.

Now it is aſked, whence it is, that objects ranged on ſtrait lines ſo wide aſunder, ſhould ſeem to approach and join each other, and that whether the ranges are ſituated ſide-wiſe, or one over the other?

The anſwer is in few words. All objects appear under the viſual angle they ſubtend at the eye. Now, be they columns, trees, animals, or any other things placed on the ſide A, K the remoteſt will ſeem to border on the center T, by reaſon they are ſeen under an angle, or ray, that is near thereto. The ray + K, for inſtance, being much nearer the central ray T, than is the ray + C or + D, of conſequence muſt appear nearer to it. If the range of objects was prolonged, they would ſtill approach nearer the central ray T, till ſuch time as they ſeemed contiguous, and only to form one point therewith.

Now, in perſpective, the ſides A K and B S do not continue parallel, but become viſual rays, which contract themſelves till they interſect each other in the point of ſight, and by that means give the diminutions of objects. Thus, for inſtance, in the ſecond figure, the eye being at a diſtance capable of ſeeing the line A B; from the two angles A, B, ariſe two rays, which proceed to the point of ſight T; which rays A T and B T receive the interſections the point of diſtance makes with the objects, which all the while contract themſelves proportionably; as will be ſhewn in the deſcription of diagonals and their ſections. By ſuch means the whole parallelograms A K B S, and all the objects on either ſide become reduced into the narrow compaſs A V, B X: and if the eye were more remote, that ſpace would be ſtill ſmaller, ſince the farther an object is off, the ſmaller it appears, as will be made appear in the following page.

1. Fig.



2. Fig

Why Objects *appear the ſmaller as they are at the greater Diſtance.*

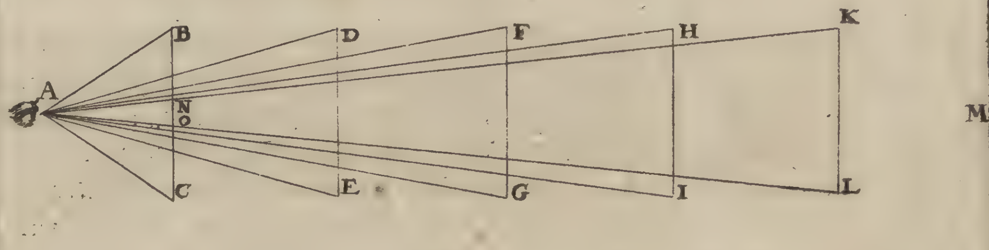
I have already obſerved, that objects appear large or ſmall according to the angle wherein they are ſeen, and that this angle is taken at the eye, where two rays drawn from the two extreme points of an object meet. The eye A, for inſtance, viewing the object B C, will draw the rays A B and A C, which give the angle B A C. But an object viewed under a greater angle appearing large, and another under a leſſer angle, little; and among equal objects, thoſe at the greateſt diſtance appearing under the ſmalleſt angle, it conſequently follows that in all perſpectives the remoteſt objects muſt be made the ſmalleſt. To illuſtrate this by an example, if the eye be in A, the object B C, which is the neareſt, will appear the biggeſt, becauſe ſeen under the greateſt angle; and the ſecond, third, fourth and fifth objects, though of equal magnitude, will all appear ſmaller and ſmaller, inaſmuch as the angles under which they are ſeen, diminiſh in proportion as the objects recede. If the eye were removed into M, K L would appear the largeſt; and B C, in this latter caſe, ſeem no bigger than N O.

The ſecond figure is a ſequel of what I have advanced. For, ſuppoſing the apparent magnitude of objects, to be ſuch as is the angle they are ſeen under, it follows, that if ſeveral lines be drawn between the ſides of the ſame triangle, then will all of them appear equal. Thus, all the lines compriſed between the ſides O N, O P, of the triangle N O P, will appear equal to each other; and as objects comprehended under the ſame angle ſeem equal, ſo all comprehended under a greater angle, ſeem greater, and all under a ſmaller, ſmaller.

Thus much premiſed: if there be a number of columns, or pilaſters, to be ranged in perſpective on each ſide of a hall or church, they muſt of neceſſiry be all made under the ſame angle, and all tend towards one common point in the horizon O, *fig.* 3d. For inſtance, the eye being placed in A, viewing the firſt object D E; if from the points D, E, you draw the viſual rays D O, E O, they will make the triangle D O E, which will include the columns D E, F G, H I, K L, M N, ſo as they will all appear equal in magnitude.

What has been ſaid of the ſides, is likewiſe to be underſtood of the cielings and pavements; the diminutions of the angles of remote objects, placed either above or below, being governed by the ſame rule as thoſe placed laterally. I need not therefore add any thing farther; unleſs, that care be taken there be as many ſquares or diviſions between the remoteſt objects as between the neareſt: for in that caſe, though diſtant objects be cloſer as they are farther from us, they will appear in ſome meaſure to preſerve their diſtance; thus, in B C, D E, the interval between the four neareſt columns, there are ſixteen ſquares, and no fewer than ſixteen between the four remoteſt K L, M N, *fig.* 4.

1. Fig



2. Fig.

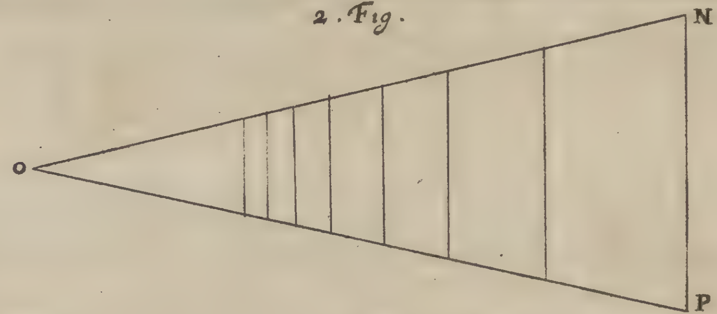


Fig 3

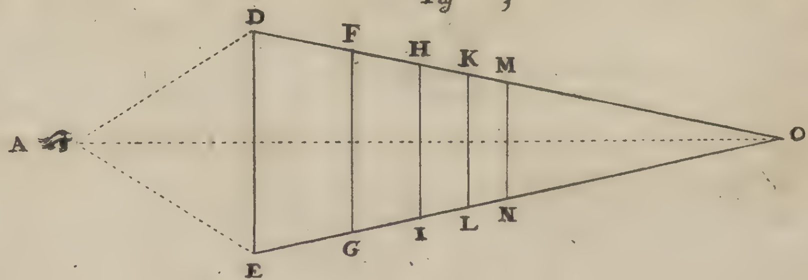


Fig 4

The Obſervations of the former page, applied to practice.

IT follows from what was ſaid in the foregoing page, that if you join two triangles, as in the laſt figure but one, for the ſides, and two others, of the laſt, for the top and bottom of an object, all four will terminate in one ſingle point A, which is the point of ſight, wherein all the viſual rays meet. And this will give a proof of what I advanced, namely, that objects diminiſh as they remove; the lower objects riſing, the upper falling, and the lateral cloſing or approaching nearer to each other. An example of all which you have in *Fig.* I. which exhibits, as it were, depths and diſtances falling back, and receding from us, though all the parts of the deſign are in fact equally near the eye, being all of them drawn on the ſame plain ſurface; but this ingenious effect is produced, and the appearance of a diſtant view procured, by comprehending and diminiſhing the objects within the triangles.

The trees in the lower figure being ranged by this rule, have the ſame effect as the columns, *&c.* The two rows are each of them comprehended within the ſide-triangle, and diminiſh as they approach the point of ſight A. The third or bottom triangle, is the earth between the trees, and the fourth or upper one, is the air; and thus an elegant deſign, highly entertaining the eye, is eaſily conſtructed.

I ſhall next ſhew, how you are to proceed in putting any plane body, or other figure, in perſpective.

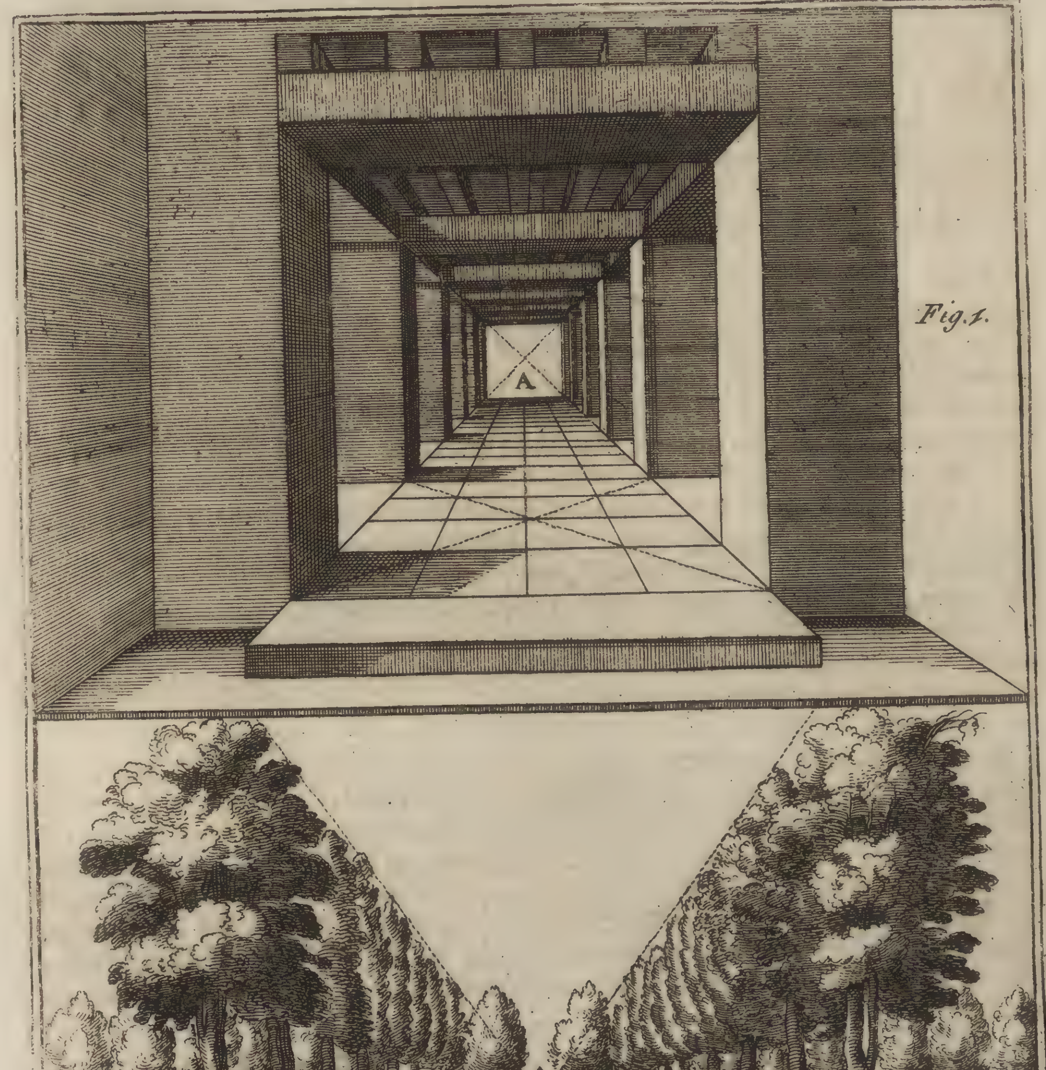


Fig. 1.

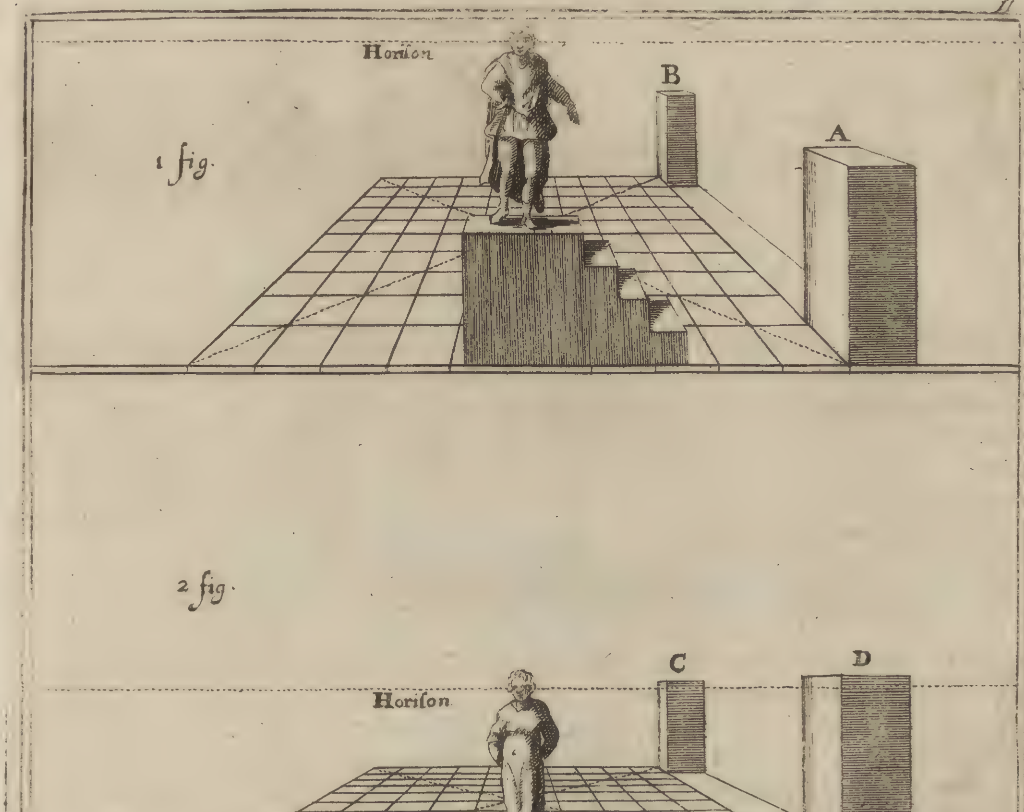
Of the HORIZON.

WHAT we call the HORIZON, in perſpective, is only a line given us by the height of our eye. Thus, if we be raiſed on an eminence, as is the man in the firſt figure, our horizon will be high. If we ſtand only on the plane, as repreſented in the ſecond figure, the horizon will be our own pitch. And if we be ſeated, as is the third, the horizon will be low. So that it is the horizon ſhews how high the eye is above the ground.

This, in effect, is the principal article in a picture, and that which directs and gives law to all the reſt; both as to the ſlope and inclination of buildings, and to the meaſures and heights of the figures. This has occaſioned a little diſpute among our beſt painters; ſome of them aſſert, that all paintings ſhould have their horizon in the work itſelf, and that perſpective allows, where the painting is raiſed very high above the eye, that it have its particular horizon. Others do not allow of a ſecond horizon, but always uſe the natural one, where-ever the painting be placed; as imagining that the whole height and breadth before them is, as it were, one large painting, from which that which is raiſed above ought to take its meaſures. The reſpect I bear to the patrons of each opinion will not allow me to determine between them; eſpecially, as ſeveral good authors have tolerated both. But if my own ſentiments were aſked, I ſhould make no ſcruple to profeſs myſelf of the opinion of theſe latter, becauſe every thing in the painting will thereby appear the more natural.

In this horizontal line are always found the points of ſight and diſtance, and ſometimes the contingent or accidental point. It is this line that terminates the view, and which, to our apprehenſion when at ſea, or on a large plain, ſeparates heaven from earth: it is always parallel to the bottom of the piece, or the plan the object is placed upon. Hence it appears, that nothing ought to be placed above the horizon, but what ſurpaſſes the height of the eye; and if an object be ſo high as that it ſurpaſſes this horizon, the plan of the ſame object muſt be placed below it. Thus, a tree or mountain may have its top above the horizon, but its bottom muſt be a good deal below it.

Whatever is below the horizon ſhews its top; but in objects ever ſo little above it, the top is inviſible. Thus the two blocks A, B, placed on the ground of the firſt figure, ſhew their tops, by reaſon the horizon is over them; but in thoſe of the ſecond figure C, D, the top does not appear; and much leſs in thoſe of the third figure: yet, in reality, they are all of the ſame height, ſo that it is the horizon makes all the difference.



Horison
B
A
1 fig.
2 fig.
C
D
Horison
3 fig
F
E
Horison

Of the Terreſtrial Line.

THE TERRESTRIAL LINE, BASE LINE, or LINE of the PLAN, is the bottom line of the drawing or plan. This is always parallel to the horizon, as is ſeen in A B of the firſt *Figure*, F G of the ſecond, and N O of the third. It is the firſt line drawn for the plan of a place; and whereon all the meaſures are to be ſet, as will hereafter be ſhewn.

Of the Point of Sight.

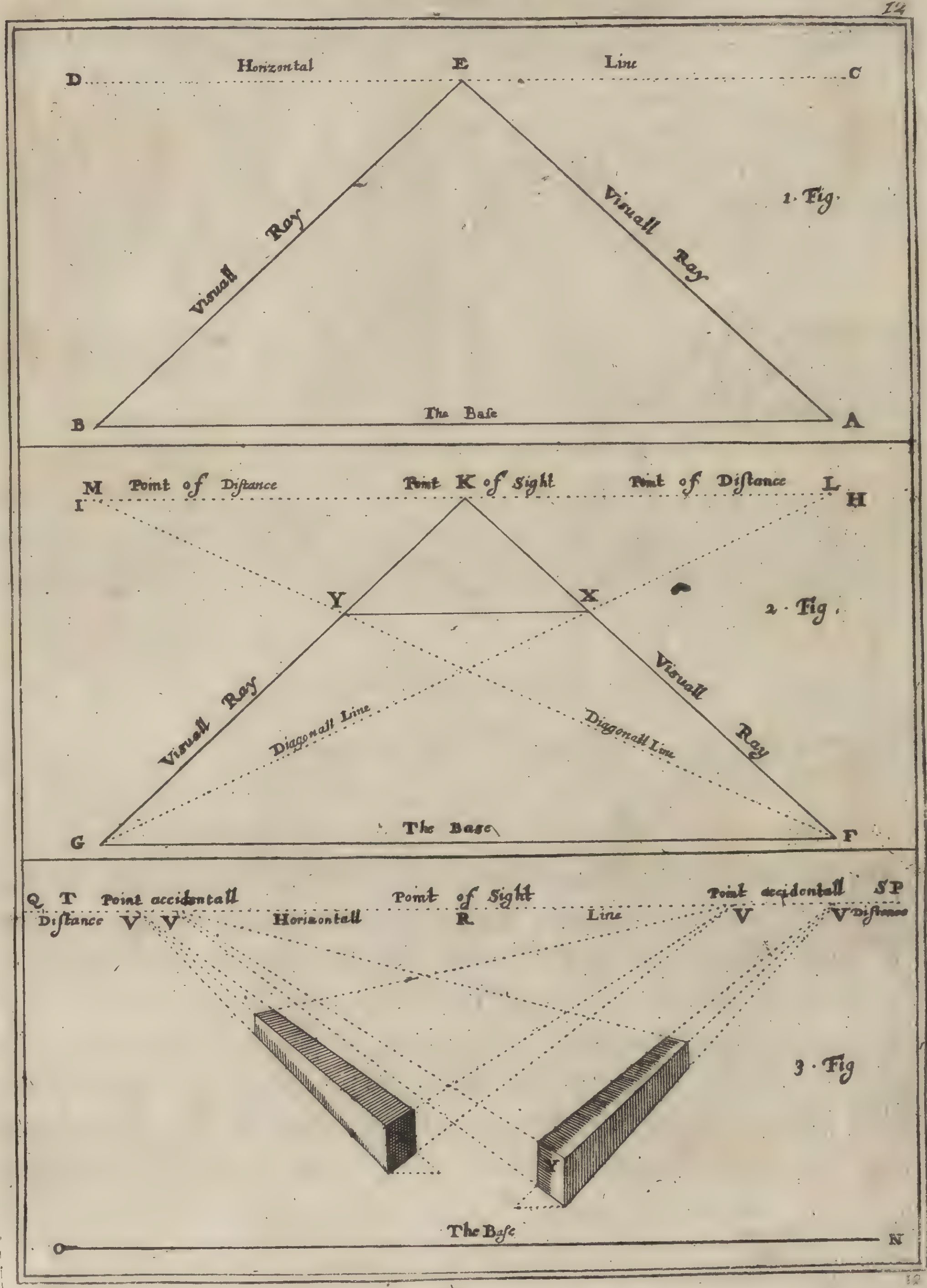
THE POINT of SIGHT is a point in the axis of the eye, or in the central ray, where the ſame is interſected by the horizon; or in other words, a point in the horizontal line where all the viſual rays terminate. Thus the point E in the firſt figure is the point of ſight in the horizon C D, wherein all the viſual rays meet. It is called the *Point of the eye*, or *ocular Point*, becauſe directly oppoſed to the eye of the perſon who is to view the piece. It is alſo called the principal point, or point of perſpective.

Of the Points of Diſtance.

POINT of DISTANCE, or POINTS of DISTANCE, is a point, or points (for there are ſometimes two of them) placed on the horizontal line at equal diſtances on each ſide from the point of ſight. They are thus denominated, by reaſon the ſpectator ought to be ſo far removed from the figure, or painting, and the terreſtrial line, as theſe points are from the point of ſight. Thus H I being the horizon, and K the point of ſight, L and M are points of diſtance, ſerving to give all the ſhortnings. Thus, for example, if from the extremes of F G, *Fig.* 2d. you draw two lines to the point K, and from the ſame points draw two lines to the points of diſtance M and L, where theſe two lines G L and F M cut the lines F K and G K, in the points X and Y, will be the line of depth, and the ſhortning of the ſquare, whereof F G is the ſide and baſe. The lines drawn to the point of ſight are all viſual rays, and thoſe to the points of diſtance, all diagonals.

Of the Accidental Points.

CONTINGENT, or ACCIDENTAL POINTS, are certain points, wherein ſuch objects as may be thrown negligently and without order, tend to terminate in the horizon. They are called accidental, becauſe they are not drawn to the point of ſight, nor the points of diſtance, but meet accidentally in the horizon as the ſituation of the objects happen. Thus, for inſtance, the two pieces of wood X and Y terminate in the points V, V, V, V, in the horizon P Q, not in the point of ſight which is R, nor in the points of diſtance S and T. Indeed ſometimes the objects are ſo ill diſpoſed, that theſe points muſt be made out of the horizon, as I ſhall have occaſion to ſhew hereafter. They ſerve particularly in the apertures of doors, windows, ſtair-caſes, and the like.



1. Fig.

2. Fig.

3. Fig

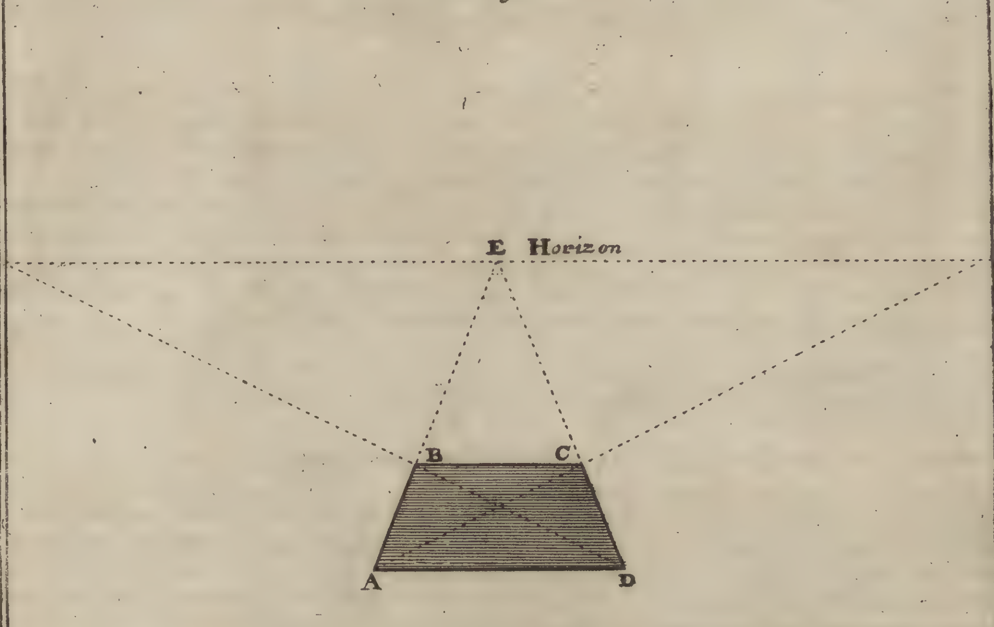
Of the Point *of the* FRONT.

THE point of DIRECT VIEW, or of the FRONT, is when we have the object directly before us, and not more on one ſide than the other; in which caſe it only ſhews the fore-ſide, and, if it be below the horizon, a little of the top too, but nothing of the ſides, unleſs the object be polygonous. Thus the plan A B C D is all in front, and, if it were raiſed, we ſhould not ſee any thing of the ſides A B, or C D, but only the front A D. The reaſon is, that the point of ſight E, being directly oppoſite thereto, cauſes a diminution on each ſide; however it is only to be underſtood where an elevation is the object, that the front or forepart can only be ſeen, for, if it be a plan, it ſhews the whole, as ABCD.

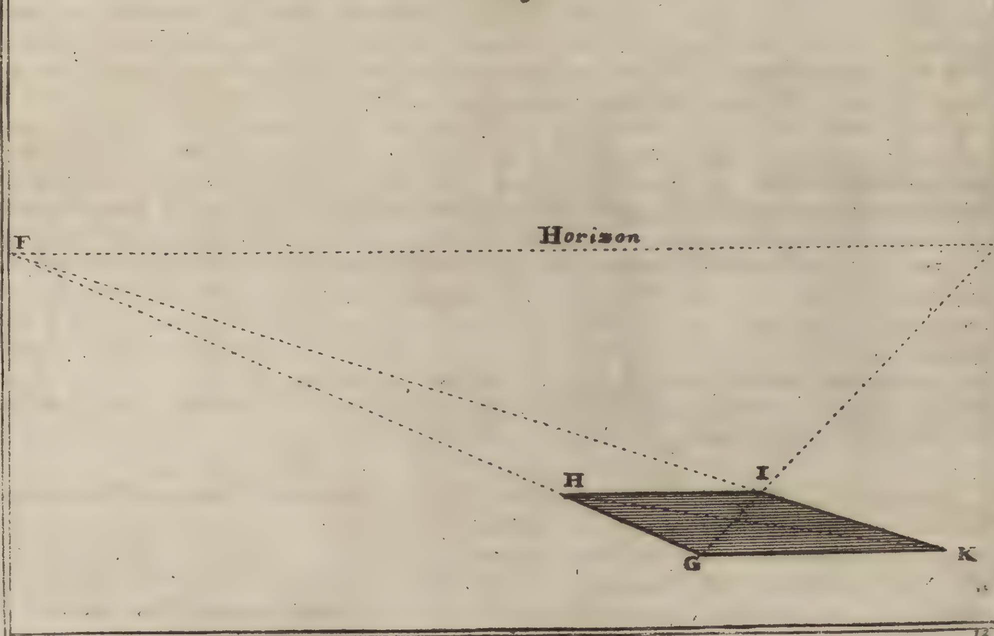
Of the SIDE POINT.

THE point of OBLIQUE VIEW, or of the SIDE, is when we ſee the object ſideways, or aſlant. In viewing the object obliquely, it preſents us two faces, or ſides; and the point of ſight, inſtead of being in the middle of the horizon, as in the former inſtance of the point of direct view, is now placed in the ſide of the horizontal line. For example, if the point of ſight be in F, the object G H I K will appear athwart, and ſhew two faces, G K and G H; in which caſe it will be a ſide point. The practice is the ſame in the ſide points as in the front points; a point of ſight, points of diſtance, &c. being laid down in the one as well as the other.

1. Fig.



2. Fig.



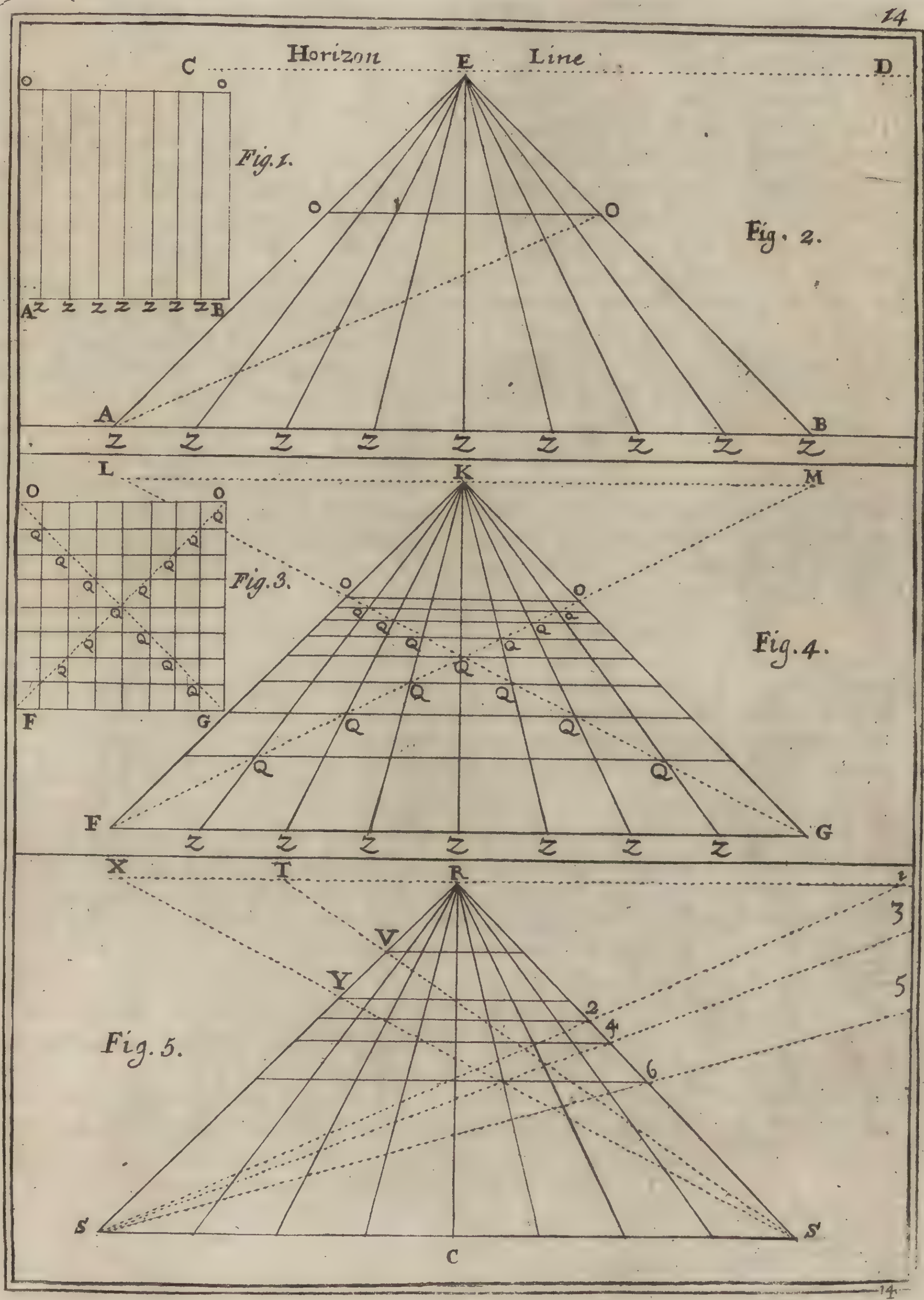
Of the Visual Rays.

IT is an univerſal rule, that all the lines, which in a geometrical plan, are perpendicular to the terreſtrial line, be always drawn to the point of ſight, when the ſame plan is to be put in perſpective. Thus, in the little plan A O, O B, *Fig.* 1. A B is the terreſtrial line, to which all the lines Z, Z, *&c.* are perpendicular. But if the plan be to be thrown into perſpective, and either a greater or a leſs line than that of the plan be pitched on, for example, the line A B, *Fig.* 2. which has the ſame number of diviſions as the ſmall one; from the ſeveral diviſions Z, the lines are to be drawn directly to the point of ſight K. Such lines are properly denominated radials or viſual rays; and the laſt of them, the extremes, as being drawn from the extremities of the terreſtrial line A B.

Of the Diagonals, *or* Diametrals, *and their* Sections.

It is likewiſe a rule, that all the diagonals of the ſquares in a geometrical plan, be drawn to the point of diſtance when the plan is put into perſpective. Thus, in the little plan *Fig.* 3. the diagonals, G O and F O, are drawn to the points of diſtance, when the ſame plan is exhibited in perſpective, and thereby the ſhortnings or diminutions of the objects are procured. For example, if from the extremes of the baſe line F G, *Fig.* 4. lines be drawn to the points of diſtance L M, they will be diagonals; and where thoſe lines interſect the extreme rays F K and G K in the points O, O, will be marked out the diminution of the ſquare, whereof F G is the ſide. And where theſe diagonals cut the lines Z, Z, *&c.* in the points Q, Q, *&c.* parallels to the baſe line are to be drawn, which will give the diminution of all the ſquares, and the ſame number of ſides as in the little plan. The more remote the points of diſtance are from the point of ſight, the more the objects are diminiſhed; hence the beauty of a perſpective depends on fixing the points of diſtance, at a proper diſtance from the point of ſight. On this account, I have added *Fig.* 5. with a diverſity of intervals between the point of ſight, and points of diſtance, to evince the truth of what is juſt now obſerved. Suppoſe then R to be the point of ſight, and R S, R S, the extreme rays; if the point of diſtance be at T, it will cut the ray S R in the point V, which will give the diminution of the ſquare, whereof S S, is a ſide. But it would be ridiculous to ſee a ſquare ſo extravagantly deep, occaſioned from the point of diſtance T being ſo much too near the point of ſight R. The leaſt ſpace in any-wiſe allowable, is for the point of diſtance to be removed from the point of ſight, half the breadth of the whole draught or perſpective; (ſuch as is the diſtance of X from R, *viz.* equal to that from the central ray C, to S;) by reaſon ſuch a diſtance makes a right angle at the ſpectator's eye. It would, however, be ſtill more agreeable at 1, the line in that caſe cutting the ſquare at 2; and it would be better yet at 3, cutting the extreme ray at 4; and beſt of all at 5; being then remote enough, and making the ſquare ſhorter at 6: the reaſon thereof will be aſſigned in the next page.

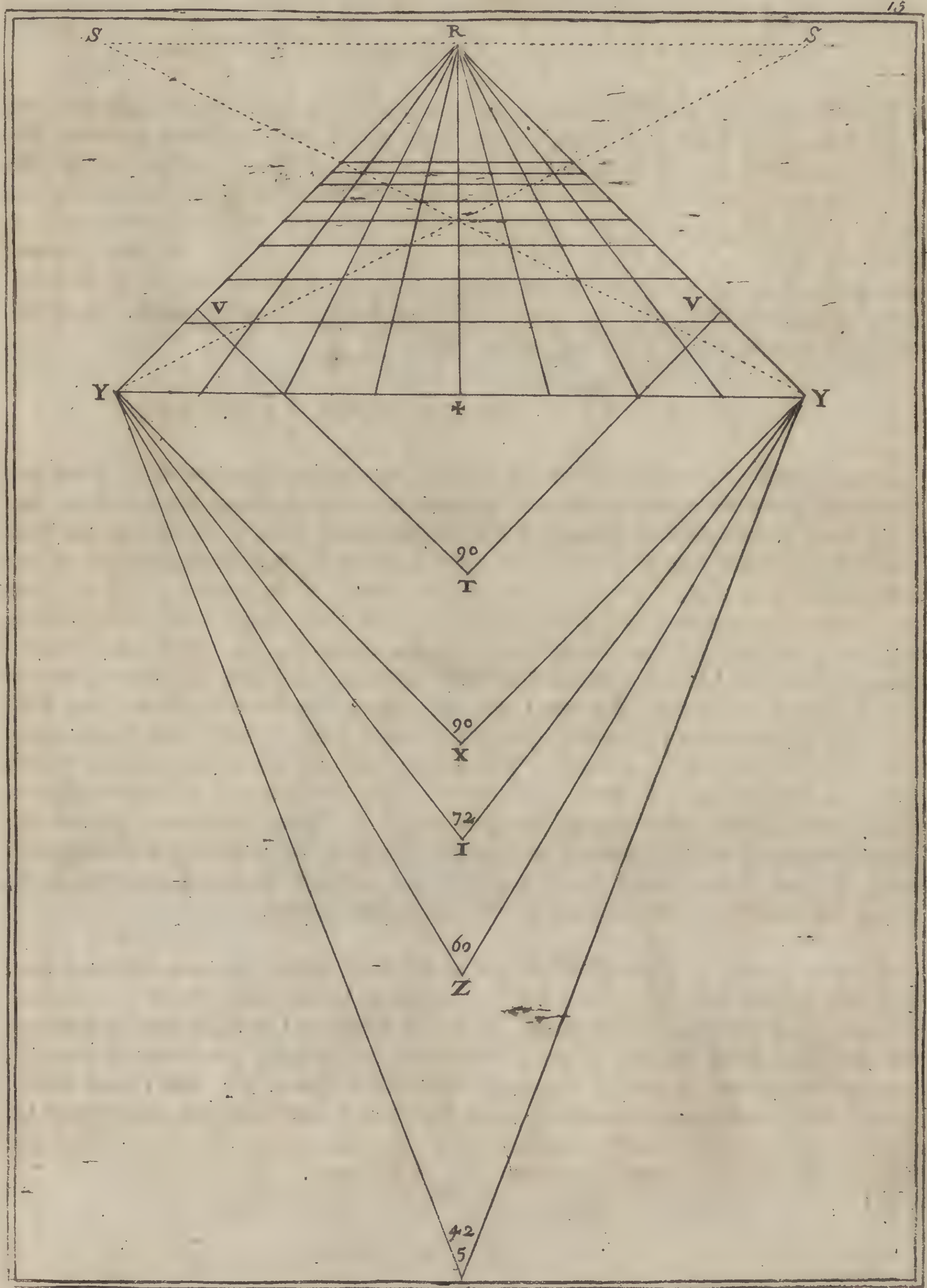
It may be demanded, why, throughout the courſe of this work, I have put the points of diſtance ſo near the point of ſight, when they have ſo much better effect at a greater diſtance? The anſwer is, that the book not being intended to be viewed merely out of curioſity, but to inſtruct, it was neceſſary every circumſtance ſhould be ſeen, that the various methods of practice might be the better conceived. For this reaſon I have included as much of the ſeveral operations as poſſibly I might.


14
Horizon
Line
C
E
D
Fig. 1.
Fig. 2.
A
B
Z
L
K
M
Fig. 3.
Fig. 4.
F
G
Q
X
T
R
V
Y
Fig. 5.
2
3
4
5
6
S
C
14

Of the DISTANCE, *or* REMOVAL.

I Have already obferved, in fpeaking of the vifual rays, page 5, that the eye cannot commodioufly take in more of them, than are included in a right angle: that is, that the fight does not receive the forms of objects fully and diftinctly, when the rays tranfmitted from their extreme points, extend beyond a right angle. The reafon is, the pupil being nearly in the center of the eye, does not well admit more than a quadrant of a circle, fo that whatever rays exceed that portion, are either not feen, or produce only a dim confufed effect. On this account, objects are feen to greater advantage under an angle lefs than a right angle rather than greater; for inftance, two thirds of a right angle, or fixty degrees, but not lefs, becaufe the rays, in fuch cafe, being fo ftraitened become indiftinct, the angle being little more than a point in the pupil. To fhew this difference in figures. Suppofe the plans and fquares the fame as in the laft figure, and the fpectator's eye at the diftance of T from the terreftrial line; the oppofite figure demonftrates it would be neceffary the angle fhould open much farther, to fee the extremes Y, Y. If it only opened to a right angle, the eye could not fee all the figure, as T for inftance could not fee beyond the points V, V. Whence would arife a very faulty perfpective, inafmuch as what would exhibit a fquare, will now only form a parallelogram. The neareft diftance for the eye is in the point X, which is the juft meafure of a right angle comprehending the whole piece Y Y. If the diftance be carried ftill farther back from the point of fight, it will be ftill more agreeable, as in I, where the angle will be only 72 degrees. If it be brought back as far as Z, it will be in perfection, inafmuch as the rays being now lefs dilated, have the more force, and exhibit objects with the greater vivacity. But I would never choofe to go beyond five, for the reafon already infinuated, that the angle then dwindles to a mere point. Too much care cannot be taken in the difpofal of points of fo much importance; with regard to which it muft be efteemed a certain rule, that the diftance be at leaft equal to the fpace between the direct ray and the corner of the perfpective. + R, for inftance, is the direct ray and X + the leaft diftance, which is equal to + Y. This meafure being taken, muft be fet off each way from the point of fight to fix the points of diftance, as here from R, to S, S; or only one way, as in the following page, for a fide point.

Thus much we learn from reafons that regard the eye; but experience furnifhes another noble rule, which may be general too, provided it be ufed with judgment, namely, that having chofe the place where the perfpective is to be made, you are to determine from what quarter it is to be feen to the beft advantage; then taking the diftance from this place to the terreftrial line, fet off this interval, by a little fcale, from the point of fight to the point of diftance, provided it be not too remote. Which is a circumftance that will require fome difcretion, to avoid the inconvenience either of placing it too near, or too far off.


S
R
S
V
V
Y
Y
90
T
90
X
72
I
60
Z
42
5

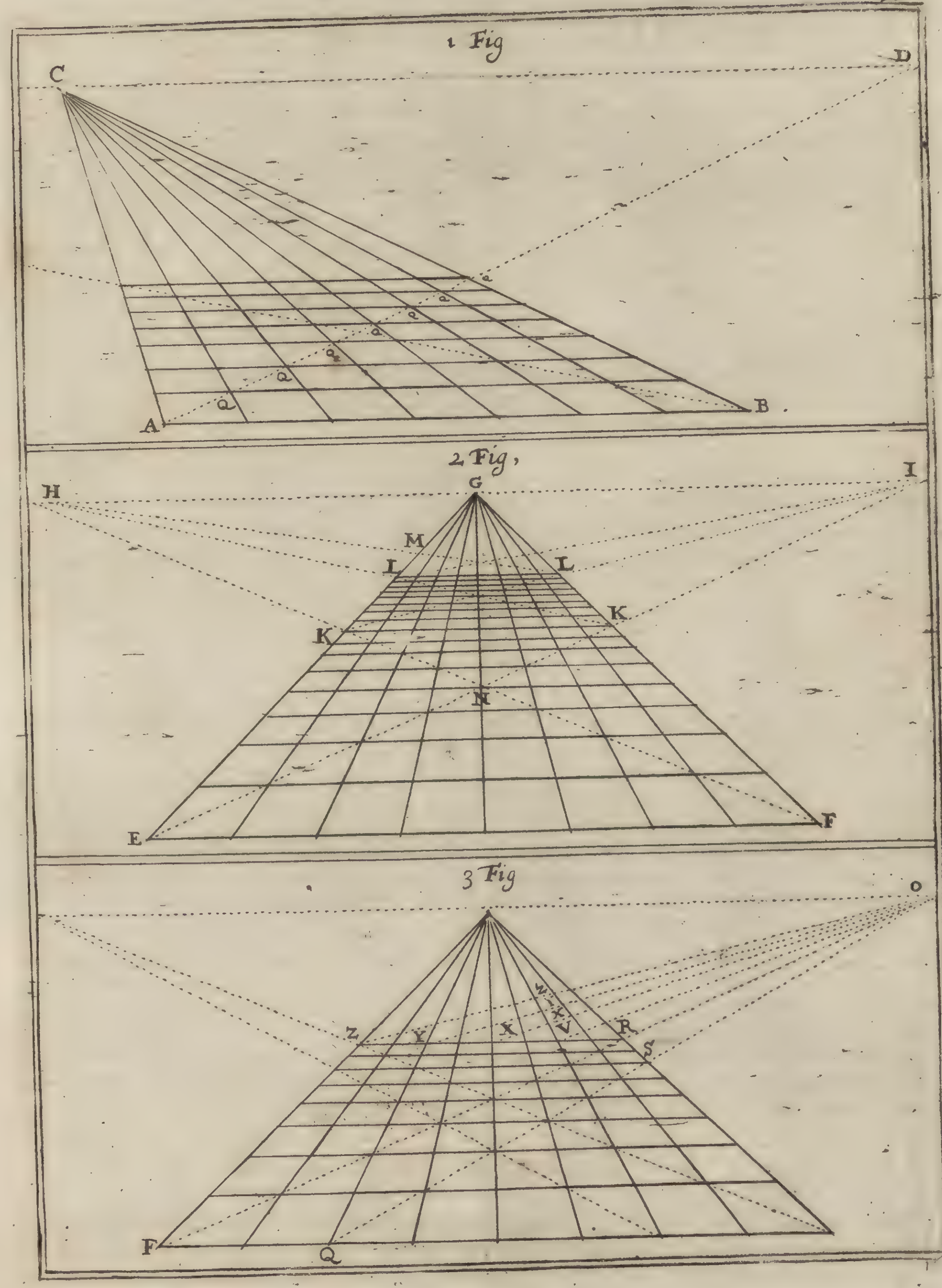
Observation I. *Relating to the* Side-point.

THE rules for the front point, are not varied in drawing the points of the fides, they are both founded on the fame caufe, which always produces the like effects. *Fig.* 1. will fufficiently fhew, that the method of practice for the fide point, is the fame as for that in front. Set off the divifion on the terreftrial line A B, and if the point of fight be fuppofed in C, and the point of diftance in D, from the feveral points of divifion draw the rays to C, then draw the diagonal line A D, and you will have the interfections Q, Q, *&c.* which give the diminutions of the fquares in the fame manner as thofe in the preceding plates. The reft will be learnt from the following rules.

Observation II. *Of the* Depths *or* Hollowings.

A perfpective may be funk to any depth, by making new terreftrial lines and diagonals in the following method. For example, *Fig.* 2. from the terreftrial line E F, draw to the point of diftance H I, the diagonals E I, F H, and where they interfect the vifual rays E G and F G, in the points K, K, the diminution of the firft fquare will be. Now, if we take this line K K for a new terreftrial line, and from its extremes K, K, draw diagonals to the points of diftance; where thefe cut the fame lines E G and F G, namely in the points L, L, will be the diminution of the fecond fquare, which will have as many divifions and fquares as the firft. Again, if we take this line L L, and repeat the fame operation, we fhall have the diminution of the third fquare in the point M. And if we begin again with this, we fhall have a fourth; and fo on, till we arrive at a point, which will be a length that will appear prodigious. By fuch means, it is eafy either to fink the perfpective plan deeper, or to fhorten it. Thus, if you would have the depth, twice its width, proceed as already directed, by drawing new diagonals at K, K: and if you would have the depth but half the width, a line drawn at N, at the interfection of the diagonals, will give your requeft.

Since it is infallibly certain that as many vifual rays as cut the diagonal line, fo many fquares of depths you have; it follows, as has been already hinted, that you may give the perfpective what depth you pleafe. For if, inftead of drawing the diagonal from the ray F to the point of diftance O, you draw it from Q, you will want two fquares of the other diminifhed fquare R; and if you would have two fquares more than the fquare R, draw a line from the fame point O, cutting two rays, to V: if you defire four, take X; if fix, Y; and if the intire fquare, Z: which is very eafy, when well underftood.


1 Fig
C
D
A
B
Q
2 Fig,
H
G
I
M
L
L
K
K
N
E
F
3 Fig
O
Z
Y
X
V
R
S
F
Q

Observation III. *Of the Meafures upon the* Bafe.

BY the bafe line alone, one may give any depth, and in any part of the perfpective at pleafure, without the ufe of fquares; which is a very expeditious way, though fomewhat difficult to learn. I fhall, however, endeavour to make it underftood, becaufe I fhall make frequent ufe thereof. For an example, *Fig.* 1. Suppofe B S the bafe line; the point of view A; and the points of diftance D, E; if now you would make a plan of a cube, of which B C is the fide, draw two occult, or dotted lines, from the extremes B C, to the points of fight. Then, to give the breadth, take the fame meafure B C, and fet it off on the terreftrial line C F; and from F draw a line to the point of diftance D; and where this line interfects the firft ray C, in the point G, will be the diminution of the plan of the cube B H G C.

If you would place the cube farther towards the middle, take the meafure B C, and transfer it on the bafe line to the diftance required, as I K; and to attain the depth, fet the fame as you would have it on the bafe line, as L: from L meafure the width, as L M; then from L and M draw occult lines to the point of diftance D, and from the points N O, where thofe lines interfect the ray K, draw parallels to the terreftrial line, and you will have the fquare Q P O N in the fituation you wanted.

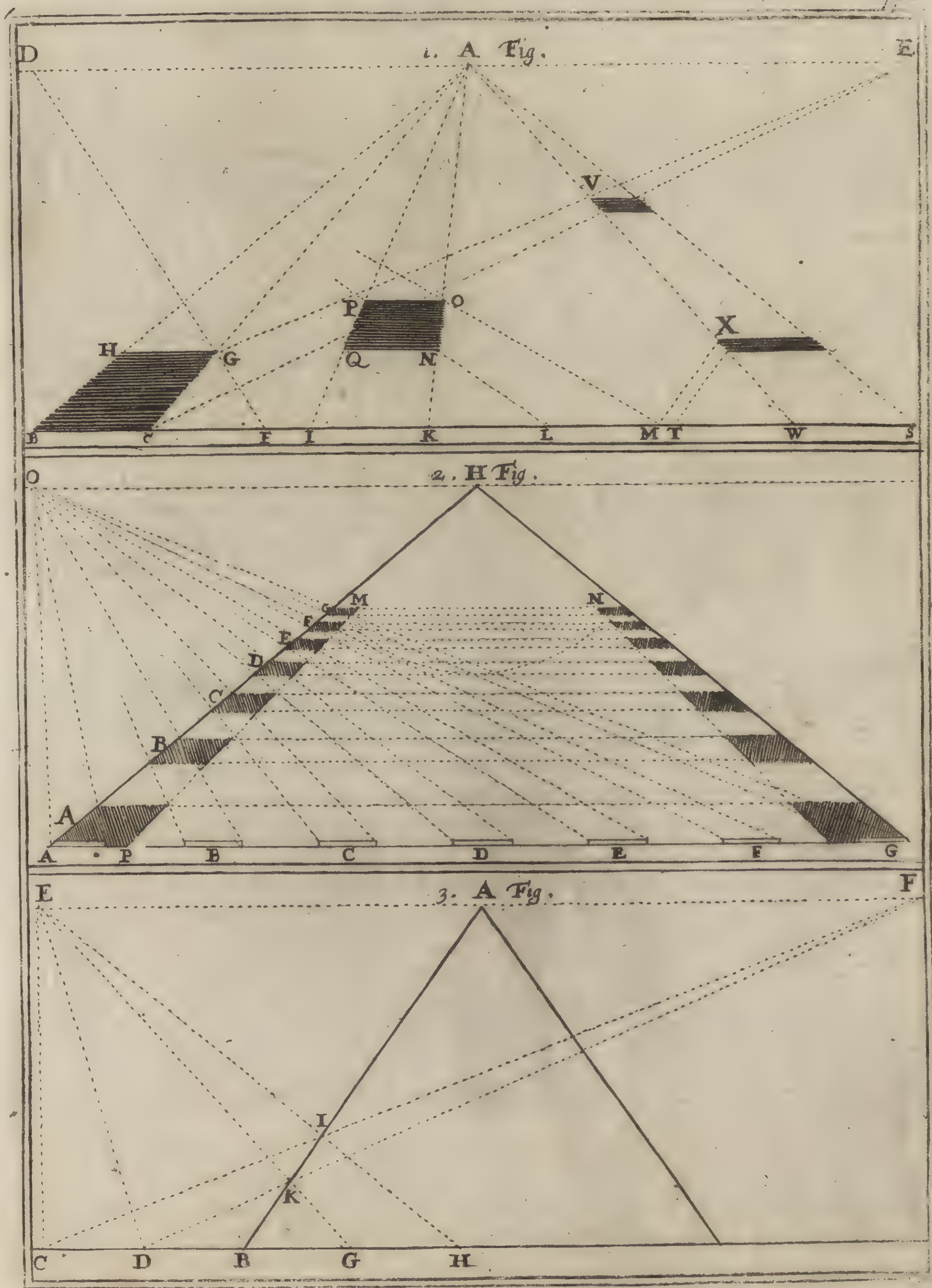
You may fet the cube on the other fide of the fquare, by transferring the meafure of the fide to W S on the bafe line, from whence draw the rays S A, W A, and perform the operation as already directed. The cube B H G C is here transferred to V, by lines drawn from the points C, D, to the point of diftance E. The interval M T, intended for a border, is fhewn in the narrow figure X, as being very near.

Observation IV. *Of the* Bafe Line, *and a fingle Point of Diftance.*

Since the depths and widths may be procured by means of this bafe line, we need not give ourfelves any farther trouble in the making of fquares; as fhall be fhewn in this example. Suppofe a row of trees, or columns, is to be projected on each fide; on the bafe line lay down the place, and the diftance between them, with their breadth or diameters, as A B C D E F G, then laying a ruler from the point of diftance O, to each of the points A B C D E F G, the interfections it makes on the extreme vifual ray A H, will be the bounds of the objects defired. To fet them off on the other fide, upon the ray G H; fet one foot of your compaffes on the point of fight H, and with the diftance H G, ftrike an arch: The point wherein this cuts the ray G H, as in N, will be the correfponding bound. Thus N will be the fame with M, and fo of the reft; through which drawing parallels, you will have the breadths. And as for the length, make it at pleafure; fetting it off from A, for inftance, to P, and then from P drawing a line to H; and where this cuts the other parallels, will be formed the plan required: which you may make either round or fquare.

Observation V. *Not to deceive one's felf in the Meafures.*

Never put any objects that are intended to be within the plan, on the fide of the point of diftance, where you are to draw lines for managing the depth. Thus, fuppofe A B the vifual ray whereon the meafures are to be marked; if you would produce the points C and D through the fame, do not draw the lines from the point of diftance E, but from that oppofite thereto, F. Or if C and D were on the infide, as G and H are, you fhould not draw from the point F, but from E; by reafon the line of interfection is found between the two. Confequently, the two will cut each other in the fame points I, K.


1. A Fig.
D
E
V
P
O
X
H
G
Q
N
B C F I K L M T W S
2. H Fig.
O
M
N
E
D
C
B
A
A P B C D E F G
3. A Fig.
E
F
I
K
C D B G H

Observation VI. *Of a single Point of Distance.*

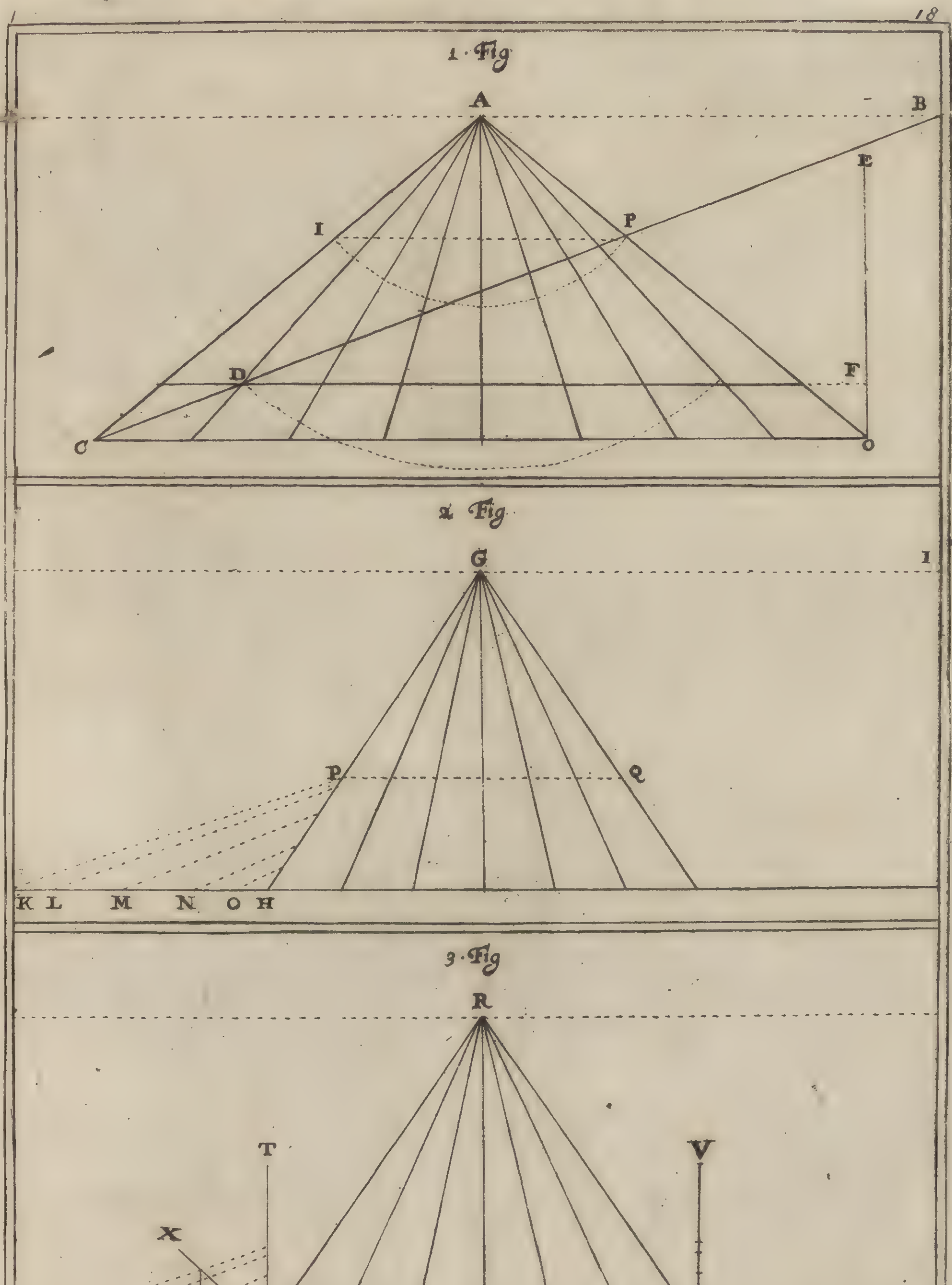
THE artist is sometimes so straitned for want of room on the place on which he exhibits his draught, that it is impossible to make above one point of distance. On which occasion, such as have been always accustomed to two, find themselves at a loss. This I am now to recover him from, and to give him to understand how a single point suffices for the operation. Suppose, then, we have a pavement to make of square stones, and that we have already drawn all the visual rays to the point A; to get the diminutions of them, draw lines to the points of distance, the intersections whereof will give us points for parallels to be drawn through. But here being only one point of distance, namely B, draw the single diagonal stroke C B, to cut all the visual rays. Then mark the same intersections on the opposite rays, for the drawing of parallels. Set, as already directed, one foot of your compasses in the point A, and sweep the other through all the intersections, as I P. This however is only adviseable for what is to be viewed in front; another method is to be given for plans to be seen sidewise, *viz.* set one foot of your compasses on the base line, and with the other take the intersection you want to transfer, as D, and set it upon the perpendicular O E, marking the extent thereof, as F; then draw a line from D to F, and you will have the same as if there had been two points of distance. And so of all the other intersections.

Observation VII. *How to perform without making Use of the* Diagonal.

If one would use the extreme ray G H for the line of intersection, the objects K L M N O must be set on the base line, and from them, lines are to be drawn to the point of distance I; which is here to be removed as far as possible that the diminution of the perspective may have the better effect. For if that point were too near the point of sight G, the objects would be too flat; I mean, for example, that a square would appear a parallelogram. Then from the point I draw lines to the several objects K L M N O, and mark the intersections thereof on the ray G H, and through these intersections draw parallels to the terrestrial line, as here P Q, *&c.* This method is not much in use, though some set a value on it.

Observation VIII. *Other methods of* Shortning *or* Diminishing.

If you chance to be straitned for space on the plane you draw upon, and cannot remove the point of distance far enough; from the foot of the ray R S erect a perpendicular T S, which will receive the intersections, and give a greater diminution. And if you would have the diminutions still more, draw a slope line, as X, which by means of its inclination, will give the intersections still closer. Then, to draw the parallels, you have nothing to do but set off the line X or T on the foot of the ray, as in V; and from those points draw parallels to the terrestrial line.


18
1 · Fig
A
B
E
I
P
D
F
C
O
2 · Fig
G
I
P
Q
K L M N O H
3 · Fig
R
T
V
X
S

PRACTICAL PERSPECTIVE.

PART II.

SHEWING THE

METHODS

OF PUTTING

PLANES

IN

PERSPECTIVE.

Of Planes *viewed directly, or in Front.*

FROM *Observation* III. and IV. page 17, as well as from the elevations that follow; it will appear that my intention is not to use geometrical plans, in order to the drawing of perspectives. That being a double labour; and there being scarce any Painter would give himself the trouble, seeing I teach him to do the same thing, by the use of the terrestrial line. But as there is no rule so general, but has its exception; so there are certain figures which cannot be put in perspective without the use of such plans. Beside, the confusion a man would be under, should a plane be given him to be exhibited in perspective, if he had not been instructed how to proceed. Therefore I am induced to give the following rules; which may suffice to shew how any plane that can be required, or even imagined, may be put in perspective.

1 *To shorten, or diminish a square*; as A B C D. From A and B, to the point of sight E, draw the lines A E, B E: and from the same angles A and B draw two diagonals F B, A G; and the points H and I, where they intersect the rays A E and B E, will give the square A B C D, diminished in A H I B. To do it without the geometrical plan; draw a line from B to F, or from A to G; or set off the line A B on the terrestrial line; as in B K: and from K draw another line to F: which will give the same intersection I, on the ray B E.

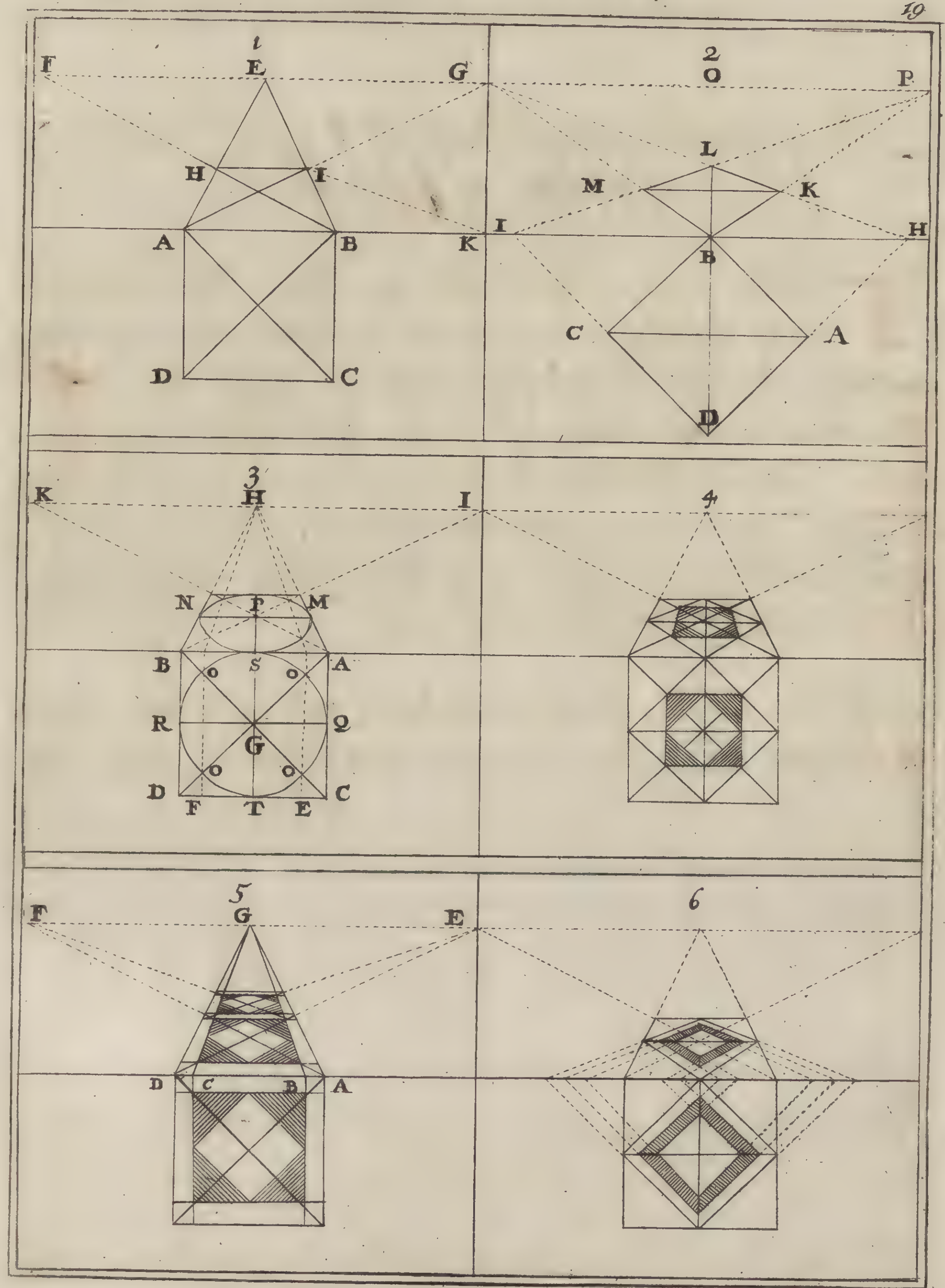
2. *To diminish a square viewed by the angle* D. Having described the plan A B C D, continue the sides D A, and D C, to cut the base line in H, and I: from the points H, and I, draw lines to the points of distance G, and P; and from the angle B, of the square which touches the base line, draw to the same points two others B G, and B P; their intersections being joined will give you the square K L M B. To do without the plan: set off the diagonal D each way from the middle point B; as to H and I, and draw the diagonals as before. But in either case no line is to be drawn from the point of sight, O.

3. *To diminish a Circle.* Draw a diameter S T, perpendicular to the ground-Line, and another R Q at right angles, which will divide the circle in four equal parts: a square A B C D described about the said circle, and drawing the diagonals A D, B C, will divide it into eight parts: from each of these points O, O, *&c.* draw perpendiculars to the ground-Line, and from each of their intersections with the said ground-Line, draw lines to the point of sight H; and where they are intersected by the diagonals A K, and B I, make points; the two last of which, M N, give the square, which is to be divided into four, by diagonals, intersecting each other in the point P. Lastly, from the extremes of this cross, draw curve lines through the said points, which will give the form of the circle in perspective. This method may serve for small circles; but for large ones we shall give another method, more exact.

4. This figure is a compound of the two first; which is all we need to say about it.

5. This too depends on the two first; only here is a list, or border, going round, which the others have not. To put the list in perspective: from the four rays A B C D draw lines to the point of sight G; and where the inner rays B C intersect the diagonals A F and D E, draw parallels to the base-line; and you will have your desire.

The sixth is the same as the second; except that it is surrounded with two borders.


19
1
F
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H
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C
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D
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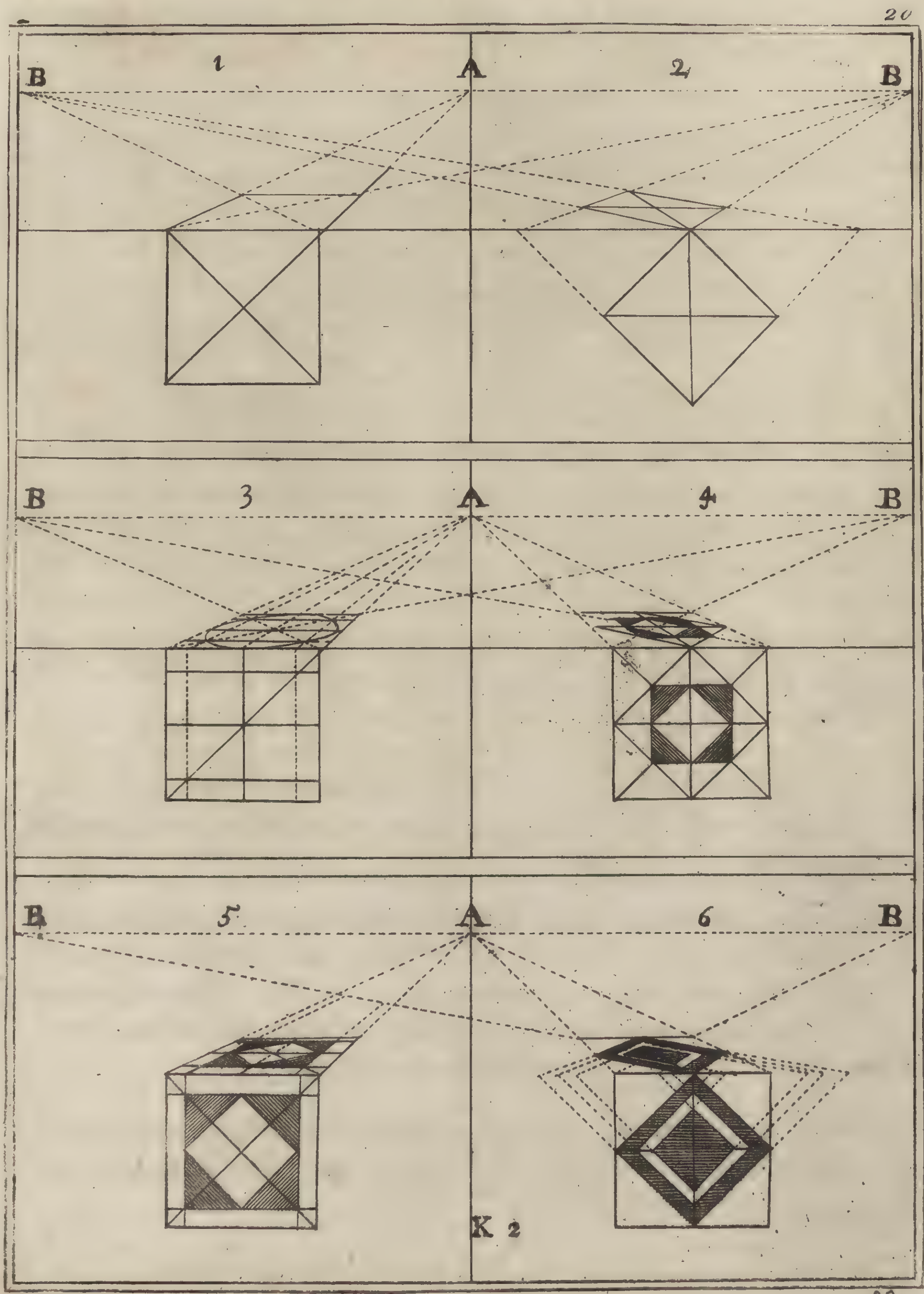
6

The perſpective appearance of PLANS *viewed obliquely, or ſide-wiſe.*

THESE plans, being much the ſame with thoſe already diſpatcht, are to be managed after the ſame manner. It would be loſing time to repeat the method of operation how they are to be diminiſhed in perſpective; a bare inſpection of the figures and lines ſufficing to ſhew, that all the difference between theſe and the former, conſiſts in the ſituation of the objects, which are here ſhewn laterally, and there in front.

All the AAA's are points of ſight, and the BBB's points of diſtance. The ſide-point has been deſcribed, page 16th.


20
B
1
A
2
B
B
3
A
4
B
B
5
A
6
B
20

The Method to find the perſpective Appearance of a TRIANGLE.

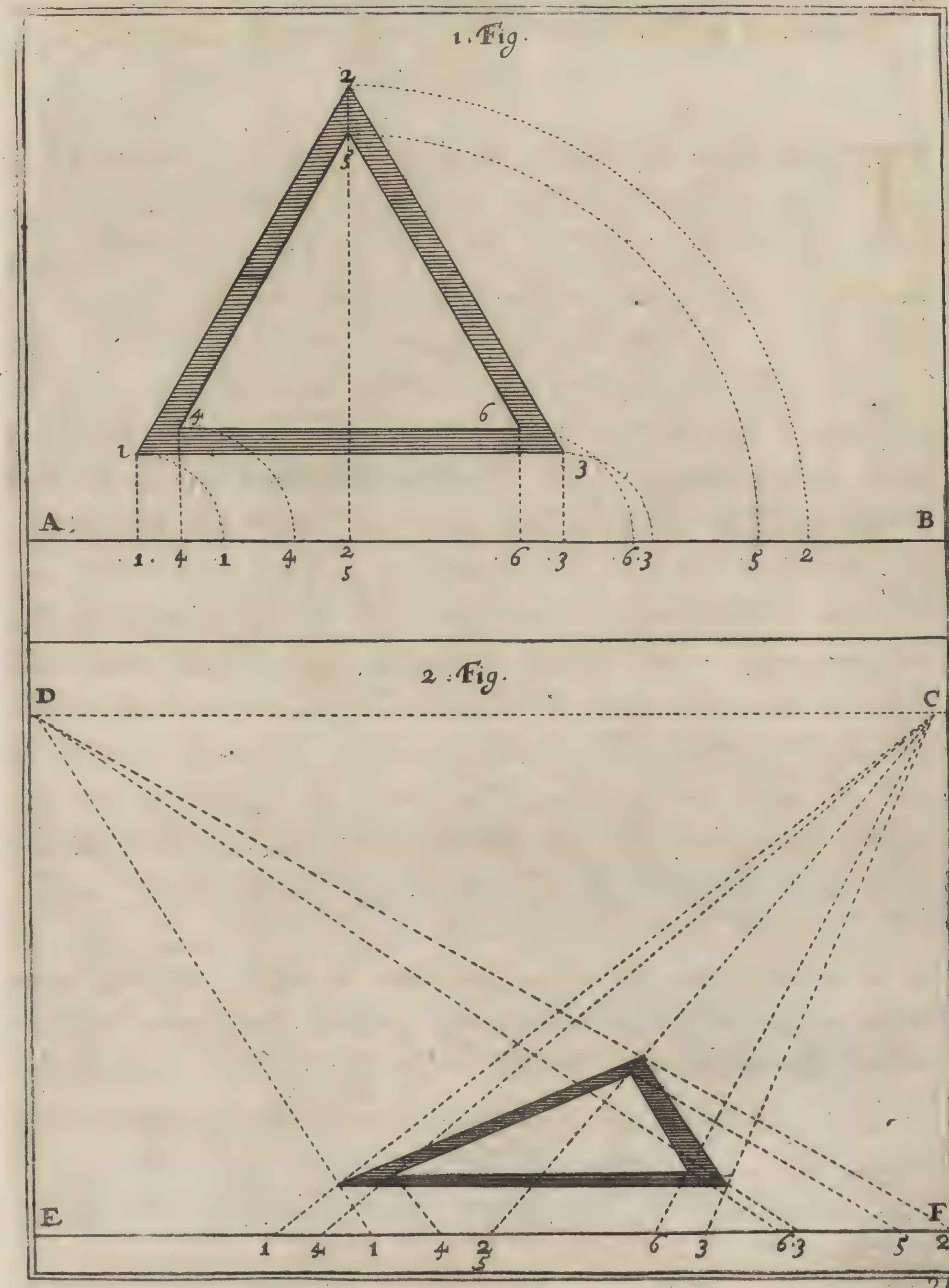
TRIANGLES, according to the order of numbers, ought to precede ſquares; but, according to reaſon, they are to come after them in this work, as being more difficult to put in perſpective. Not on account of the plan, which is eaſy enough, as only conſiſting of three lines joined together, but on account of the obliquity of its ſides.

I come now to apply ſome of the obſervations, page 17th, relating to the meaſures on the baſe line A B: for, to exhibit this triangle in perſpective, whoſe baſe 1. 3. is parallel to the fundamental line A B, from all the angles thereof, 1, 2, and 3, perpendiculars are to be drawn to A B. Then ſetting one foot of your compaſſes in the interſections, with the other ſet off the diſtances of the parts of the object from the terreſtrial line, along the ſame line, by ſtriking arches, as from 2 to 2, from 3 to 3, *&c.* This done, having drawn another baſe line in another place, as here under E F, transfer the meaſures from A B to E F, and to the point of ſight C draw lines from the points 1, 2, 3, *&c.* Laſtly, having pitched one point of diſtance D, draw lines thereto from the other points of depth, 1, 2, 3, *&c.* And between the interſections made by theſe with the viſual rays, lines, being drawn, will give the triangle required.

If you would give it the lift or breadth, repeat the ſame over again for the ſeveral inner points thereof; only uſing other figures to prevent confuſion; as, next to 1, 4; next 2, 5; 3, 6, *&c.* Then drawing perpendiculars to the point C, and between the points where they interſect the others, draw lines as you ſee in the ſcheme.

The equilateral triangle, ſuch as that here deſcribed, is inſcribed in a circle, that is a circle may be drawn about it, every ſide ſubtending 120 degrees.

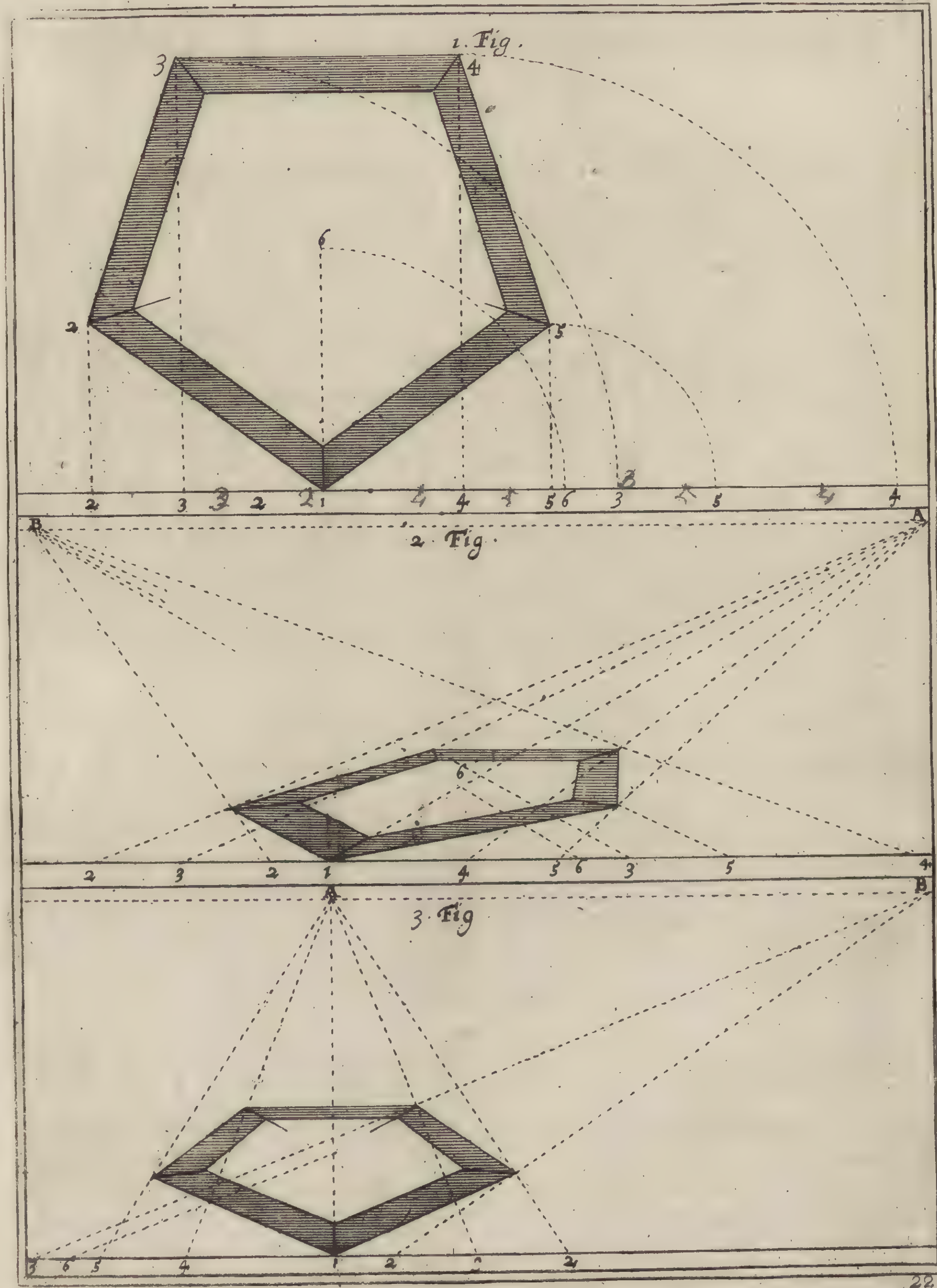
Note. The ſame operation will ſerve for all ſorts of triangles.


1. Fig.
2
5
4
6
1
3
A
B
1 4 1 4 2 5 6 3 6 3 5 2
2 Fig.
D
C
E
F
1 4 1 4 2 5 6 3 6 3 5 2

To exhibit a PENTAGON, *or figure of Five-Angles, in perſpective.*

THE way to conſtruct a pentagon is to deſcribe a circle, and divide it into five equal parts, of ſeventy-two degrees each. Then, for putting it in perſpective, the method is the ſame as has been ſhewn for the triangle, as will appear in viewing the figures and the lines of operation. The liſt or breadth is added, becauſe when I come to treat of elevations, inſtances will be given in objects that have broad edges. The exterior pentagon muſt be firſt compleated on the baſe line, and the inner one afterwards, by the ſame method of proceeding. The reader was inſtructed herein, in drawing the rim of the triangle in the former page. The point of ſight, both of the front and ſide, is A; the point of diſtance B; the viſual rays, which are the perpendiculars drawn from the angles of the plan to the baſe line, are drawn to the point of ſight A; and the other rays that give the diminution, and the place of the angles, to the point of diſtance B. As 2 cuts the ray marked 2, which gives the angle 2, 4 gives the angle 4; and ſo of the others. All the reſt is clear enough; regard, however, is to be had to one thing, that all the angles tend towards the center 6: for this reaſon the center is to be marked in the plans in perſpective, as well as in the geometrical plans.

22

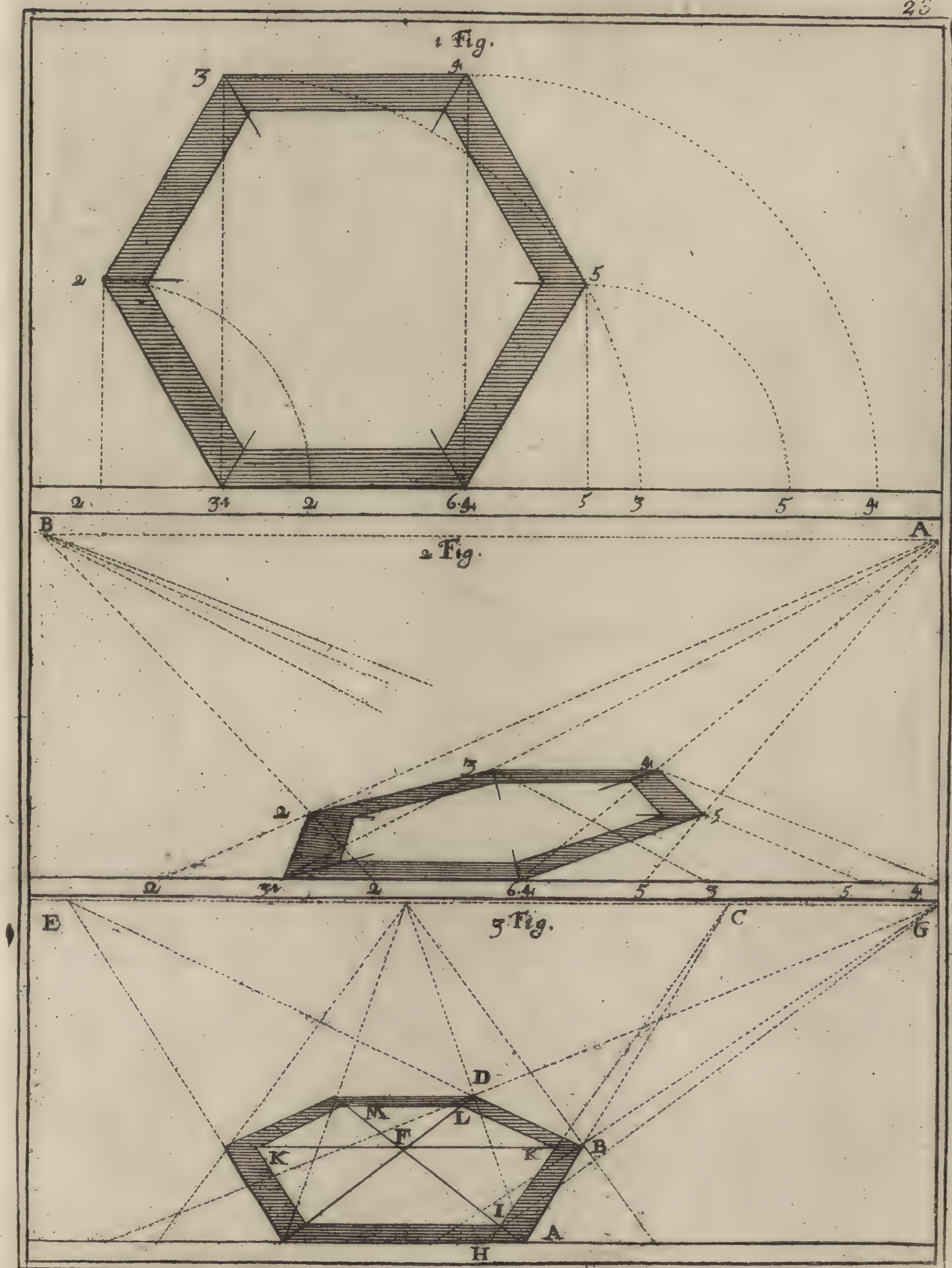


To find the perſpective Appearance of an HEXAGON, *or Figure of Six-Angles.*

THE HEXAGON is a plane with ſix angles, and as many ſides. If the ſides be equal, it is a regular hexagon, and the eaſieſt to deſcribe of all the polygons, (figures of more than four ſides and angles) by reaſon the ſame aperture of the compaſſes, which circumſcribes it within a circle, is the meaſure of its ſides, *viz.* 60 degrees each. In other words, the ſide of a hexagon is equal to the radius of a circle circumſcribed about the ſame. As to the putting it in perſpective, the method does not at all differ from that of the triangle, or pentagon; either when ſingle, or with the liſt or thickneſs, A is the point of ſight, and B that of diſtance.

Since I have a good deal of room in this page, I think it not amiſs to give a brief method of putting the liſts or thickneſſes of all polygons, regular or irregular, in perſpective. And the preſent hexagon ſhall ſerve for an example of this propoſition. Suppoſe the exterior lines of the plan of *Fig.* 3. to be only laid down, and it were required to give it a liſt or thickneſs within: to do this in perſpective, lay your ruler along the ſides, and make points in the horizon where it cuts the ſame; thus laying it along the ſide A B, it will cut the horizon in C; then laying it along B D, it will give the point E; and the like of the other ſides. Before you proceed any farther, draw occult lines from the ſeveral angles through the center F, which lines are to receive the interſections that give the diminutions. Such diſpoſitions made, ſet the breadth of the band or liſt on the baſe line, as A H, and draw the firſt breadth to the point of diſtance G, and where the line G H cuts I, will be the bound of the thickneſs of the firſt ſide, which is to determine for all the reſt. For from this point a line is to be drawn to the point correſponding to this ſide C, and the interſection of this line with K will give the diminution; from the point whereof drawing a line to the point E, correſponding to the line B D, you will have the diminution for the point L, which ſerves for the laſt ſide L M. Then transferring all the ſame meaſures to the other ſide, you will have the figure complete, by the formation of the inner hexagon.

Hereafter we ſhall have occaſion to give another method.


23
1 Fig.
3
4
2
5
2
3 1
2
6 4
5
3
5
4
B
A
2 Fig.
3
4
2
5
2
3 1
2
6 4
5
3
5
4
E
3 Fig.
C
G
D
M
L
F
K
K
B
I
A
H
27

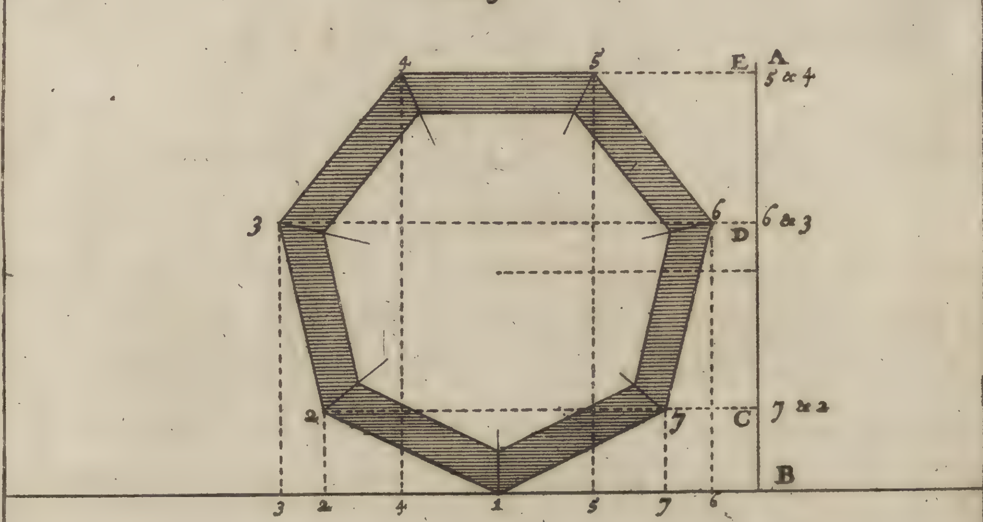
To exhibit the perſpective appearance of the HEPTAGON, *or figure conſiſting of ſeven ſides and ſeven angles.*

THE HEPTAGON is formed within a circle, as the other polygons are; in order to which the circle is divided into ſeven parts, each ſide ſubtending 51 deg. 25 min. and ſometimes more. The method of putting it in perſpective is the ſame with that of the preceding ones, as to the perpendiculars falling from the angles to the baſe line, which are all drawn to the point of view A; but as to the diminution, and the lines that give the points of the angles, it is different, and rather according to the ſeventh *Obſervation*, page 18; though I do not abſolutely approve that, as thinking the eighth *Obſervation* the better. But to condeſcend to ſuch as do uſe it, and ſhew them that it does not diminiſh enough.

Having drawn perpendiculars from the angles of the plan to the terreſtrial line, as in the preceding caſes, a perpendicular is to be made on one ſide, as A B, to receive the interſections of the parallels drawn through all the angles. Thus, the firſt angle being placed on the terreſtrial line of 2 and 7, I draw a parallel through both, cutting the perpendicular in C. After the ſame manner, the angles 3 and 6 give the interſection D, and 4 and 5 the interſection E. This line A B, thus divided, muſt be ſet off the baſe line of the plan to be diminiſhed, beginning to put the point B in F, as in the figure. Then making the other diviſions C D E, and from theſe drawing lines to the point of diſtance O, from the interſections of the extreme ray draw parallels to the terreſtrial line, and where theſe cut the rays that bear the numbers of the angles, points are to be made, which, being joined by right lines, will give the figure deſired. As to the thickneſs, or liſt, it is to be made after one of the preceding manners.

9

1 Fig.



E
A
5 & 4
4
5
3
6
6 & 3
D
2
7
C
7 & 2
B
3
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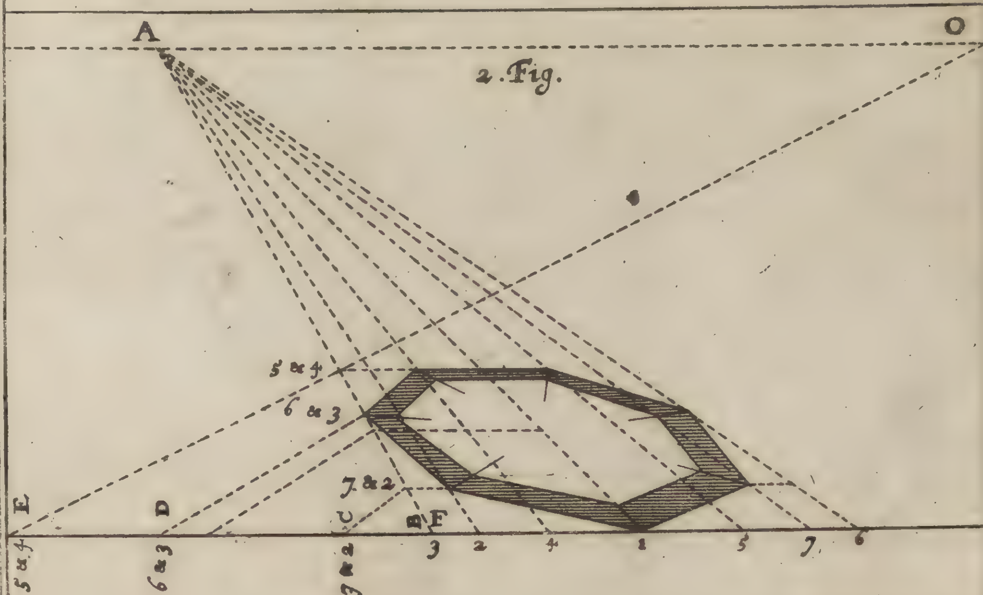
1
5
7
6

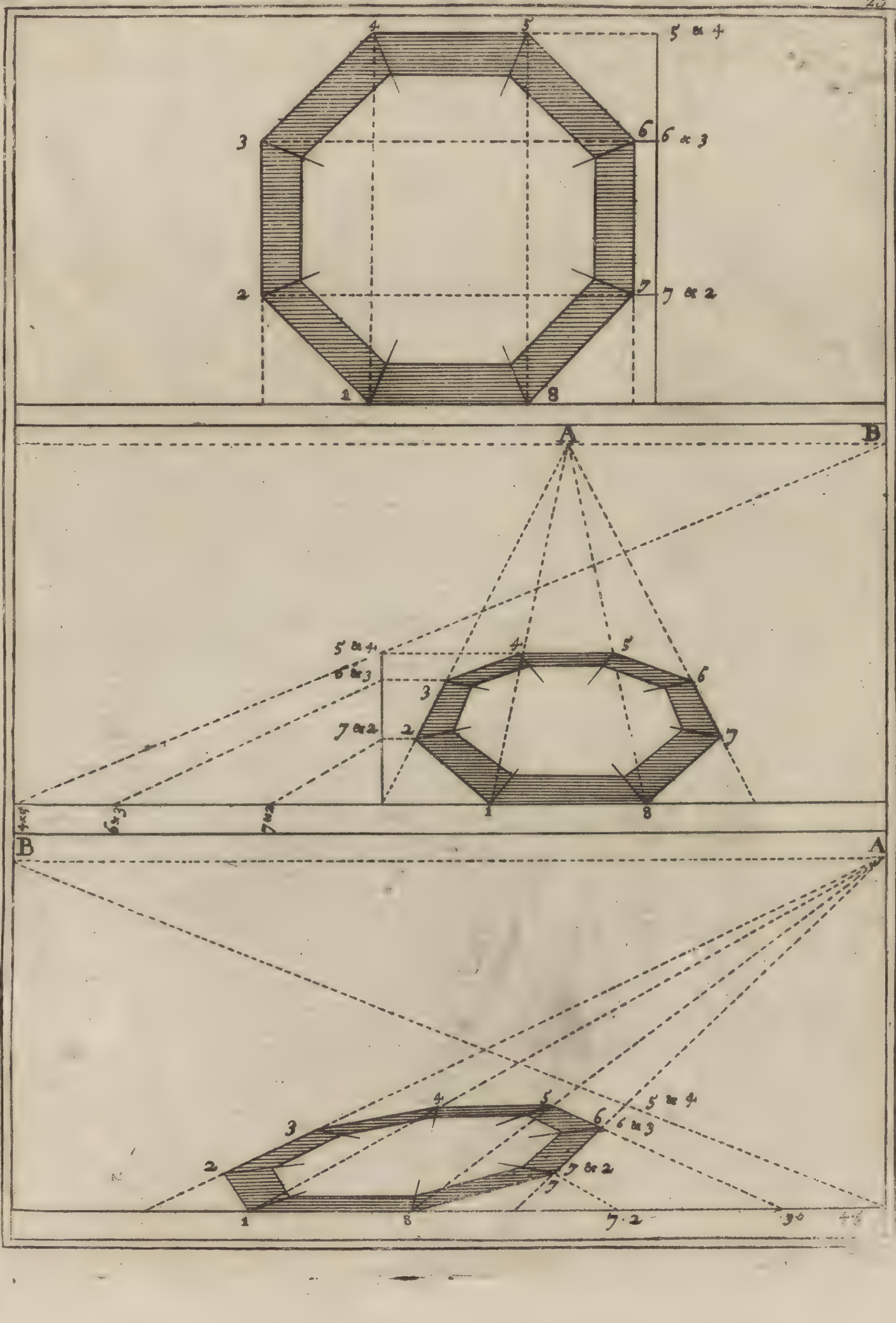
2 Fig.



A
O
5 & 4
6 & 3
7 & 2
E
D
C
B
F
5 & 4
6 & 3
7 & 2
3
2
4
1
5
7
6

To exhibit the perſpective Appearance of the OCTAGON, *or Figure of* Eight Angles.

THE octagon is formed of a circle divided into eight parts, of forty-five degrees each, from the diviſions whereof, lines being drawn, will form an octagon, that is, a figure compoſed of eight angles, and as many ſides. The rules already delivered, ſhew abundantly how it is to be put in perſpective, whether for a front or a ſide view. I ſhall only obſerve here, that the front plan is to be diminiſhed according to *Obſervation* VIII. page 18, and the ſide plan according to the VIIth *Obſervation* in the ſame page. The point of view is A, and that of diſtance B. The reſt is too obvious to need an explanation.


4
5
5 & 4
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6 & 3
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7
7 & 2
1
8
A
B
5 & 4
6 & 3
3
4
5
6
7 & 2
2
7
1
8
B
A
4
5
5 & 4
3
6
6 & 3
2
7 & 2
7
1
8
7.2

Another Method for exhibiting the OCTAGON *in perſpective.*

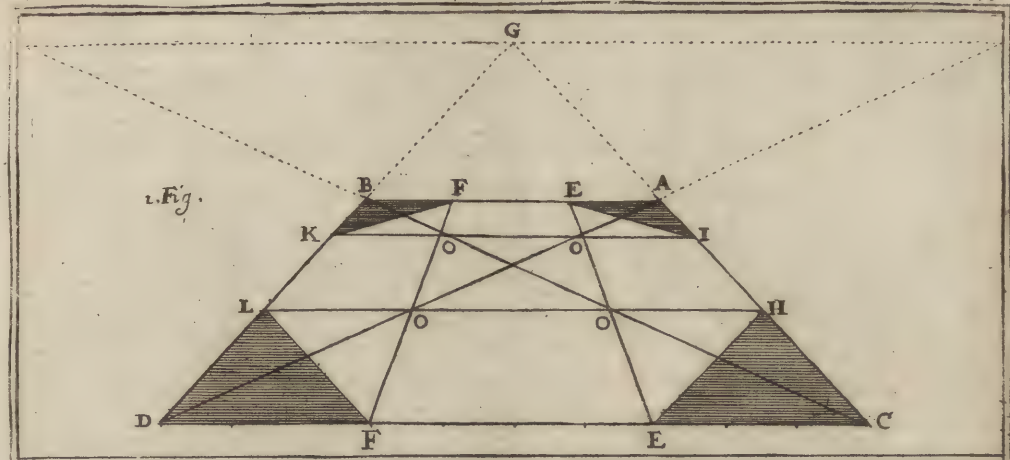
THIS method of conducting the OCTAGON was invented by *Serlio*. The practice is thus: having found a ſquare ABCD the ordinary way, divide the baſe line C D into ten parts, and, leaving three on each hand, from the third of either ſide E and F, draw lines to the points of ſight, G, and through the interſections of thoſe lines with the diagonals O, O, draw parallels to the terreſtrial line, cutting the ſides of the ſquare in the points H, I, K, L: then joining the points E H, I E, F K, L F, by lines, you will have an octagon, as in the preceding figure.

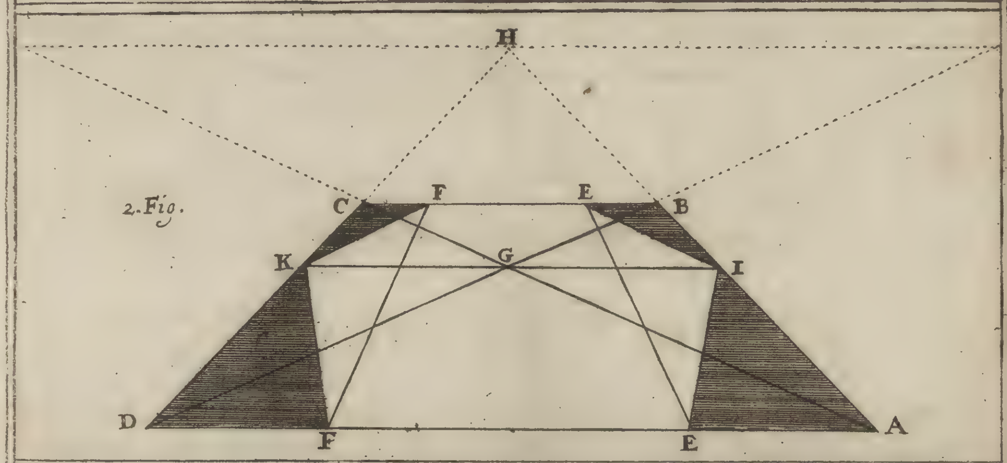
To find the perſpective appearance of the HEXAGON, *or figure of* Six Angles, *by the above method.*

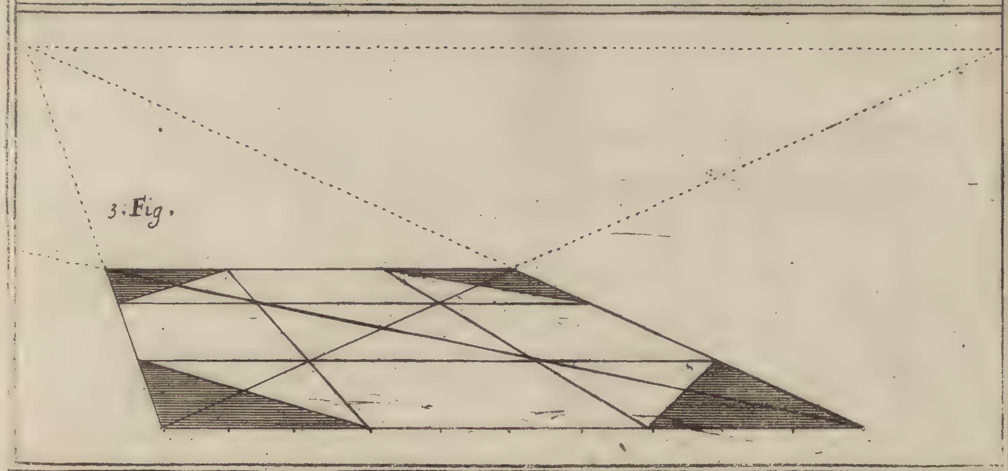
THE ſame *Serlio* has contrived a like way of managing the HEXAGON. Suppoſe, as above, a ſquare A B C D, and the baſe line A D divided into four parts, from one of which, on either ſide E and F, draw lines to the point of ſight H; then through the interſection of the diagonals, which is the middle of the ſquare G, draw a parallel to the baſe line, cutting the ſides of the ſquare in I K; laſtly, drawing lines through theſe points E, I, E, and F, K, F, there will be found a hexagon.

I ſhall ſay nothing of the octagon, *Fig.* 3. viewed ſidewiſe; ſince, as it has been ſo often repeated, the method is the ſame as for that viewed in front, *Fig.* 1: the operation is plain and ſimple, the lines drawn at *Fig.* 3, ſhew it at the firſt inſpection.

26







Of the Double OCTAGON, *or the method of adding breadth or thickneſs to an octagon, by the operation of the circumſcribed ſquare.*

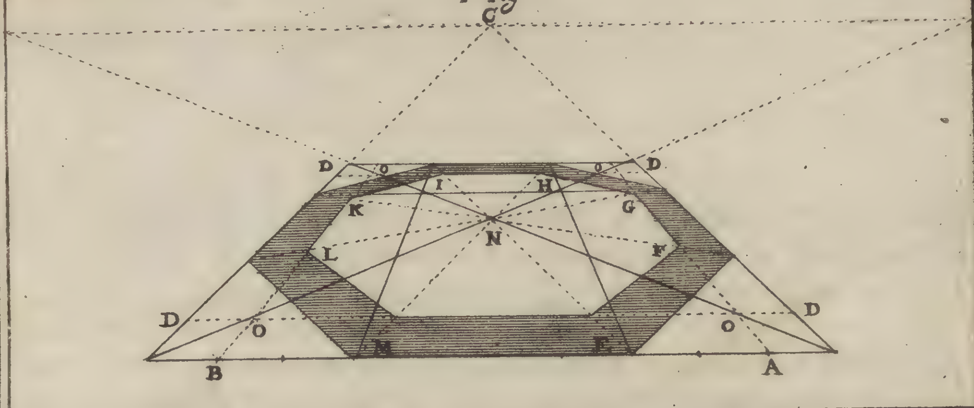
SUPPOSING a ſingle octagon already made, if it is required to have it double, or to give it a thickneſs, or liſt, proceed thus. Set the breadth or thickneſs you are willing to give it, within the ſquare which circumſcribes the octagon, as here at A B; and from theſe points draw lines to the point of ſight C; and where theſe lines cut the diagonals, as in O, O, draw parallels D D, which will form a ſort of band within the ſquare; laſtly, draw occult lines from angle to angle, interſecting each other in N; and where they cut the lines of the inner ſquare, namely, in the points E, F, G, H, I, K, L, M, will be the bounds of the inner octagon.

Of the Double HEXAGON.

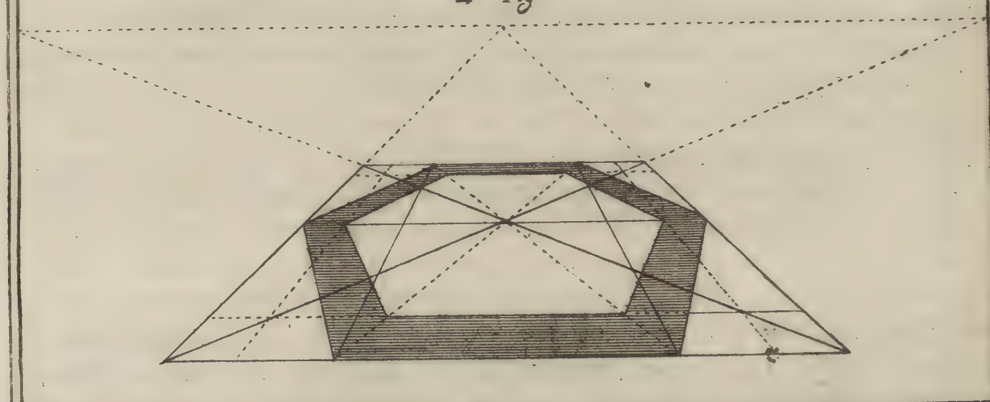
AN hexagon circumſcribed with a ſquare, will receive a liſt, or inner hexagon, by the ſame method of operation. It would be needleſs to repeat particulars, ſince the figure will clear any doubts that may ariſe.

The octagon viewed ſidewiſe, is managed preciſely as that viewed in front; the point of ſight is A, and that of diſtance B.

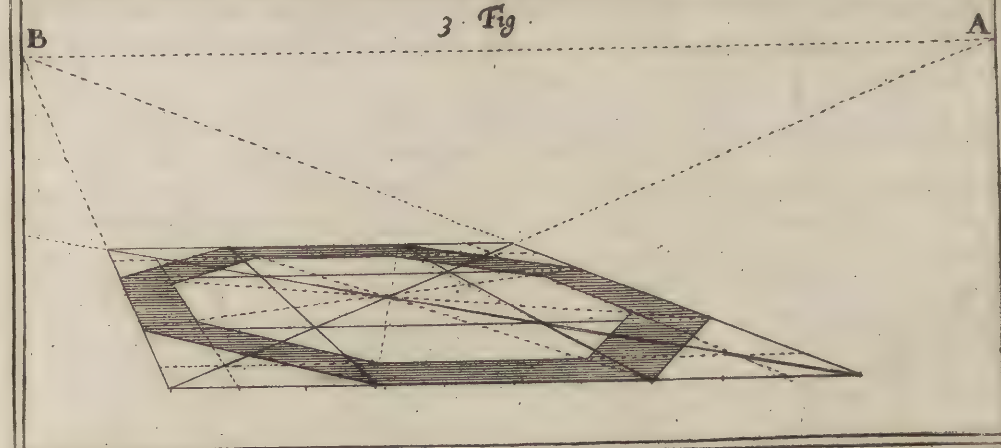
1 Fig



2 Fig



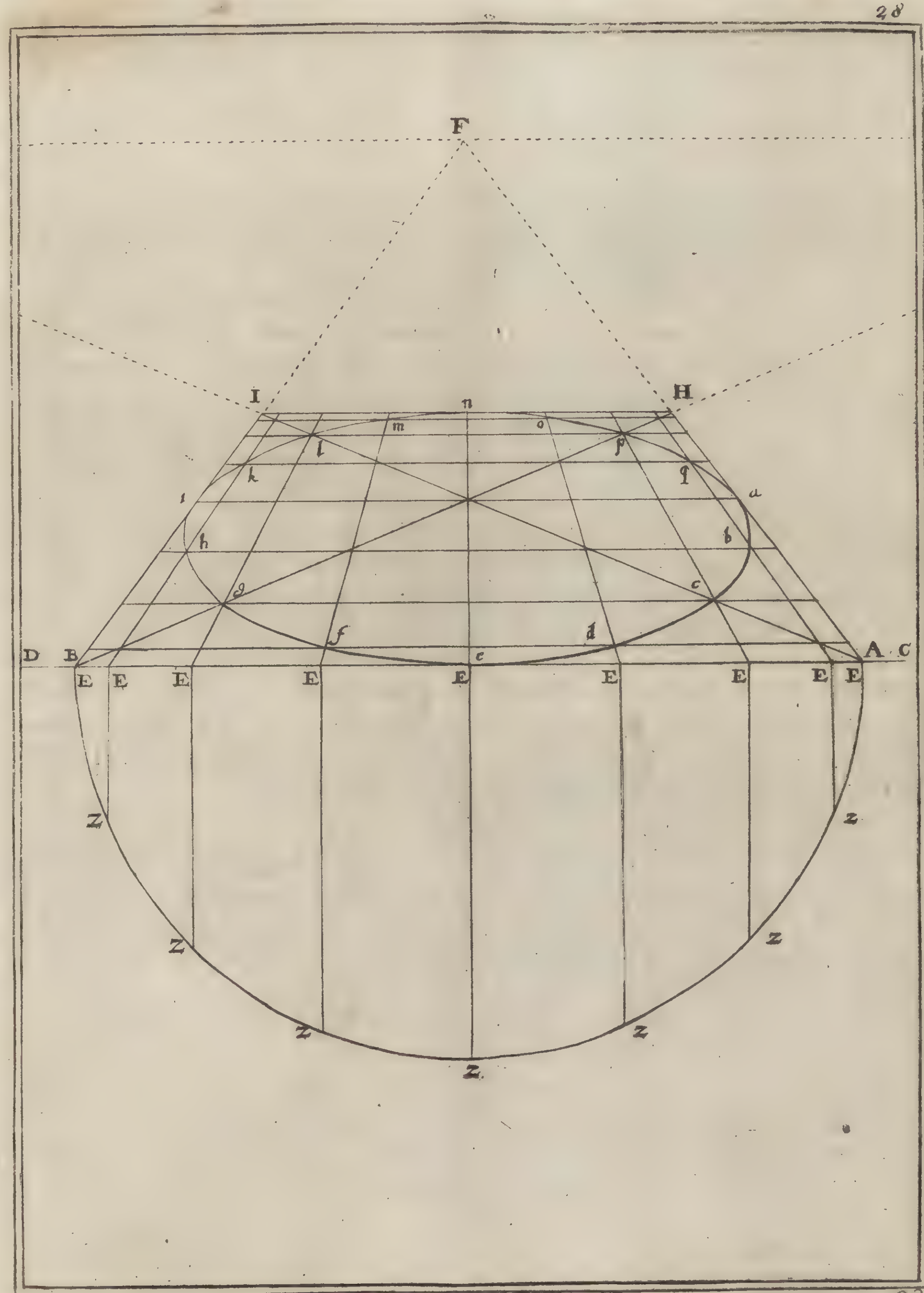
3 Fig



To exhibit the perſpective of a CIRCLE.

IF the circle be ſmall, you are directed, page 19, to an eaſy method of projecting it, by circumſcribing a ſquare about it. If the circle be large, take the following method, which *Serlio* has directed. Set one foot of your compaſſes in the middle of the fundamental line, with the other deſcribe the ſemi-circle A Z B, divide it's periphery or circumference into any number of equal parts at pleaſure. You will ſee in the proceſs, that the more of theſe diviſions, the eaſier it will be to form the circular lines, from the junction of which the circle receives it's appearance. The ſemi-circle A Z B is here divided into eight parts, which is the uſual practice. From the ſeveral diviſions Z Z, *&c.* perpendiculars are raiſed to the baſe line in the points E E, *&c.* this done, the two diagonals are to be drawn to the points of diſtance, which are here removed beyond the compaſs of the plate, but which are to be ſuppoſed, as uſual, in the horizon. Thus you get a ſquare A H I B; and this ſquare thus formed, draw lines or rays from all the points E towards the point of ſight, as far as the line H I, and through the interſections of thoſe lines with the diagonals, draw parallels; then, beginning in the middle of one of the ſides of the ſquare to make a point, as *a*, connect it by a circular line with the oppoſite angle *b*, and proceeding thus with arches from angle to angle, according to the direction of diagonals through the points *a b c d e f g h i k l m n o p q*, you will have your circle in perſpective.

By this method, it is apparent how any curvilinear figure may be projected on a plane, and therefore how neceſſary it is, to have this rule of the projection of the circle very familiar, becauſe of the frequent uſe thereof in columns, vaults, arches, apertures of doors, windows, &c.


28
F
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D
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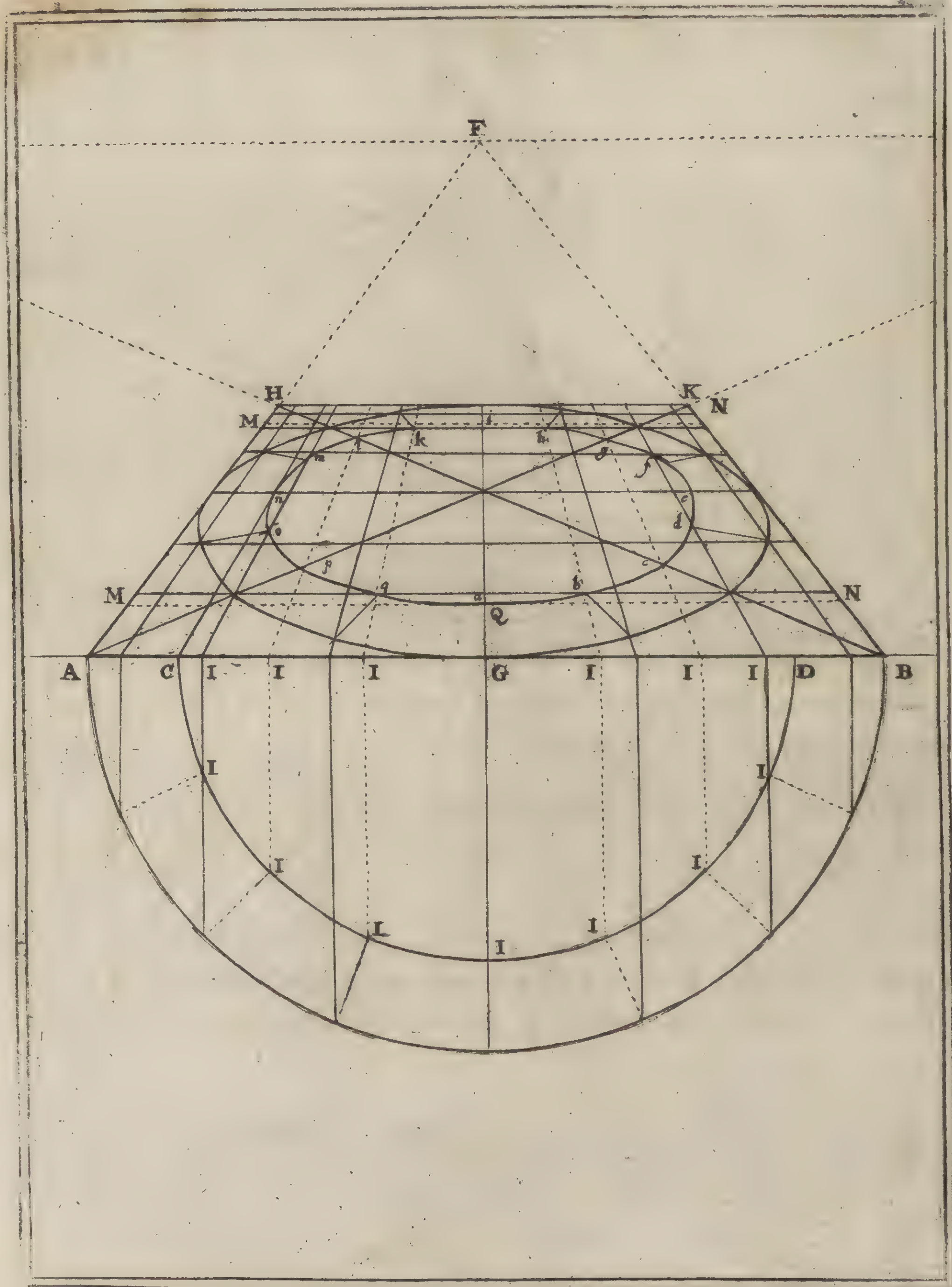
Z

To exhibit the appearance of a Double Circle.

THE outer circle is fuppofed the fame that I have juft now been defcribing; and it is required to give it a thicknefs, or lift, by making another within-fide thereof. Thus, give it any breadth at pleafure, as, for example, A C: from G the center of the outer femi-circle, defcribe the inner one C D, which you are farther to divide, like the great one. Thefe divifions are eafily procured, by drawing lines from the divifions of the great femi-circle to the center G; the interfections of thofe lines with the inner femi-circle at I I I I, *&c.* are the points of it's divifions. From thefe points raife perpendiculars to the bafe line A B, and, to prevent confufion, let thefe laft lines be dotted. This done, proceed by drawing lines from the new points C I I I I D on the bafe line, towards the point of fight F, as far as the line H K, and through their interfections with the diagonals draw the two parallel dotted lines M N, which will give the breadth the circle is to have at G Q, and it's furtheft diminution. Laftly, draw lines from all the angles on which the great circle is produced, towards the center, and the points wherein they interfect the dotted lines *a b c d e f g h i k l m n o p q*, will be the points, which, connected with curve lines, will form the inner circle's circumference.

A perfon who fhould defire a plan of three, four, five, or fix circles in perfpective, muft lay them all down in the geometrical plan after the fame manner as the fecond femi-circle is done in this example, and then obferve the fame method of procefs.


F
H
K
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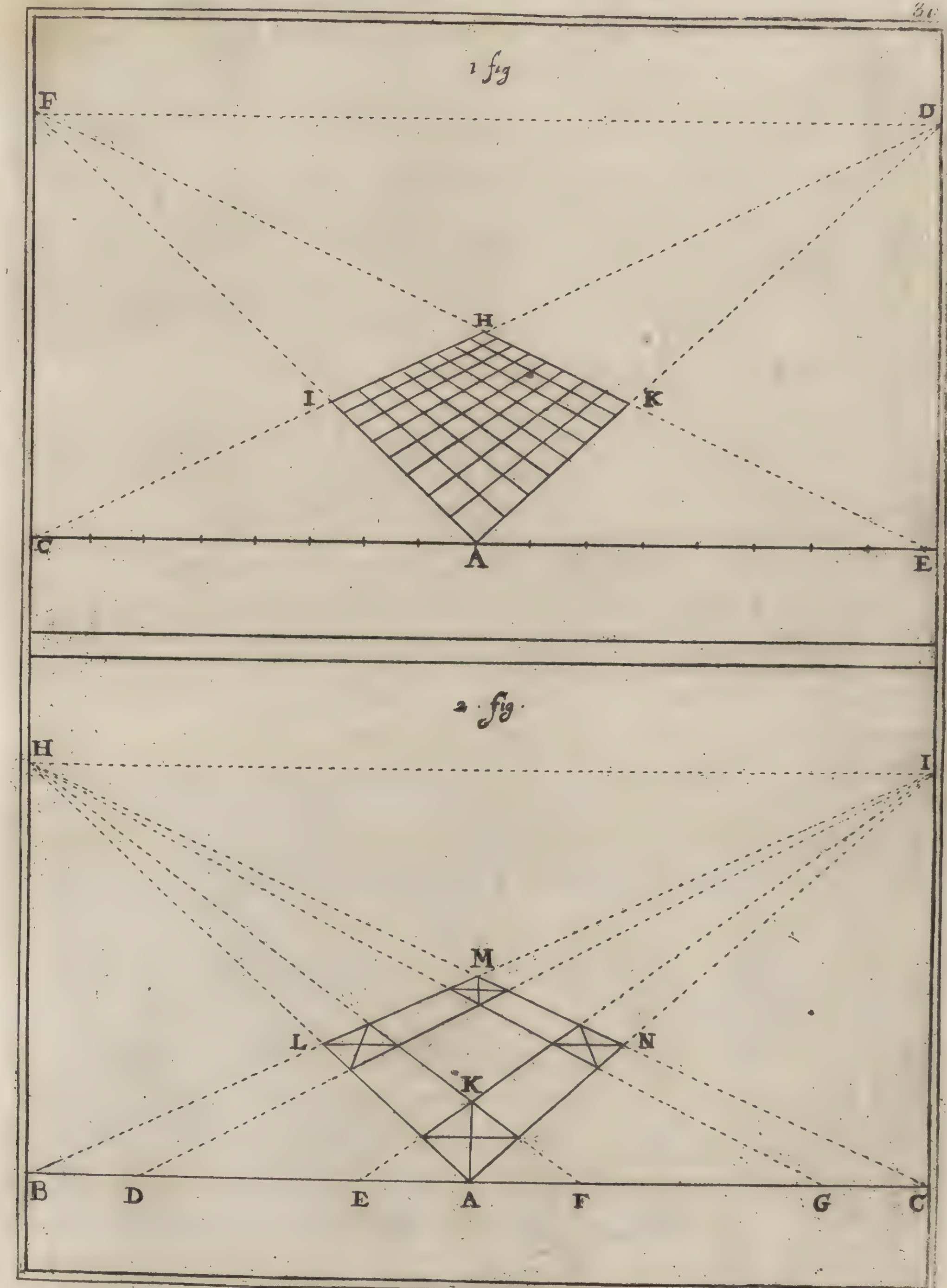
M
M
N
Q
A
C
I
G
D
B
L

To exhibit the appearance of the PLAN *of a* Square *viewed Angle-wiſe.*

IF it be required to draw a ſquare, viewed by an angle directly oppoſite to the eye, there is nothing more requiſite than to ſet off the diagonal of it upon the baſe line; as here A C is equal to the diagonal of the geometrical plan of the ſquare to be projected. Then from the points A and C to draw two lines to the point of diſtance D, then to ſet off the meaſure of the line A C on the baſe line towards A E, and from E A to draw lines to the point of diſtance F, and the three interſections of the lines H I K will be the bounds of the ſquare deſired, *viz.* A I H K.

When ſuch a plan is to be divided into ſeveral parts, lay down the number of diviſions required between the points C and A, and the ſame number on the other ſide A E; and from all theſe points draw lines to the points of diſtance; as in the preſent figure, which has eight ſquares on each ſide, and ſixty-four in all.

If in the ſame plan, thus viewed by the angle, inſtead of the diviſions in the firſt figure, it were required to have little plans in the four corners, as four lodges, columns, trees, or other objects, ſet the width of each on the baſe line, as B D, E A, on the neareſt ſide, A F, G C, on the other ſide; from which points drawing lines to the points of diſtance H I, their interſections will give the four plans K L M N required.


1 fig
F
D
H
I
K
C
A
E
2 fig
H
I
M
L
N
K
B
D
E
A
F
G
C

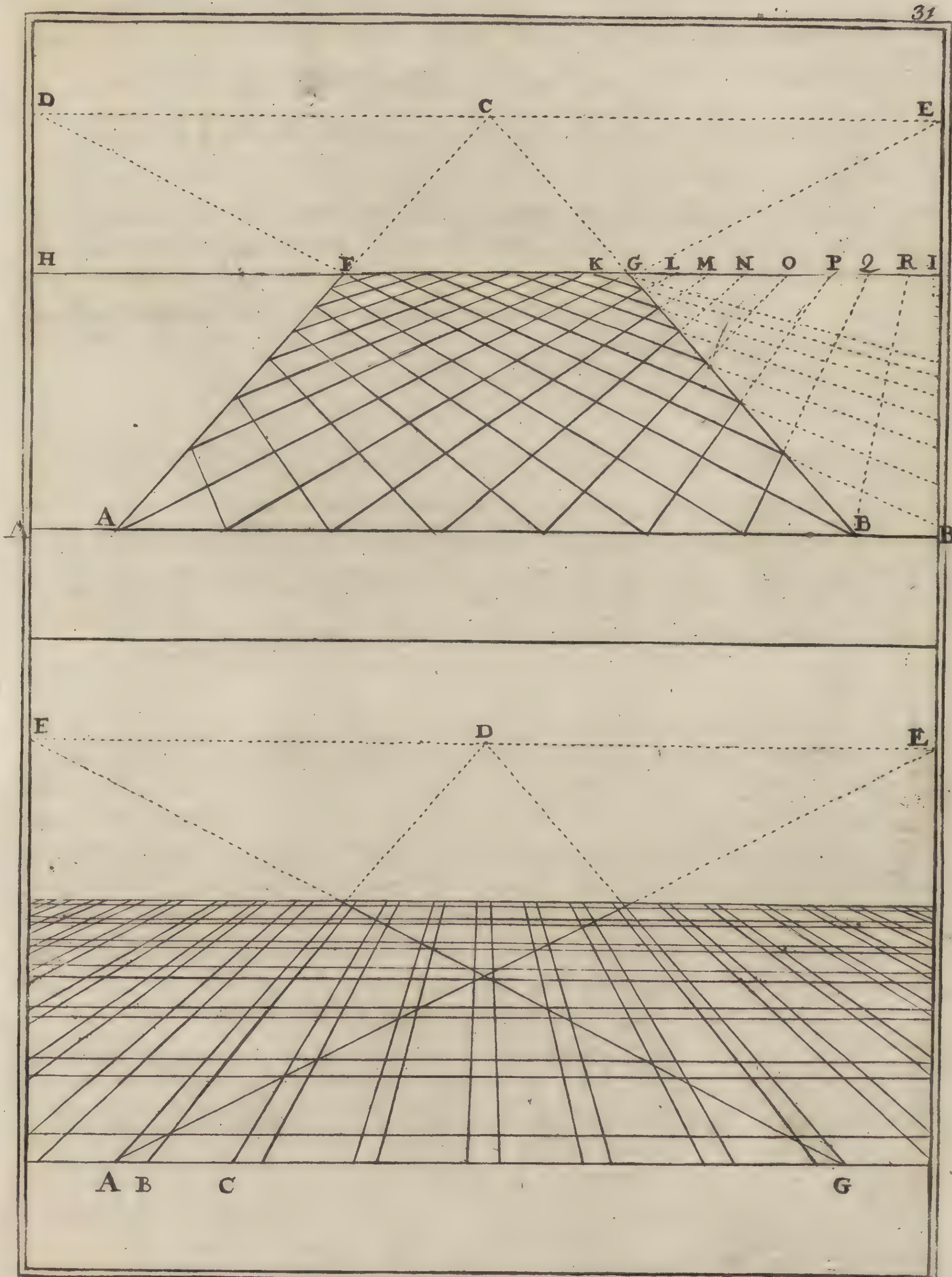
To exhibit the perſpective of a Pavement *of* Square-Stones, *viewed by the* Angles.

NOW we are about places viewed angle-wiſe, it may not be amiſs to ſhew how the pavement of a hall, church, or other place, is to be conducted. Having drawn the horizon parallel to the terreſtrial line A B, the point of ſight C, and the points of diſtance D and E, divide the baſe into as many parts as you would have ſquares; then draw lines from the extremities thereof A and B, to the point of ſight C, and from the ſame points A and B, draw two diagonals to the points of diſtance D E, the points of interſection F G will give the ſquare of the hall, and through them the line of depth H I is to be drawn. Then draw lines from all the diviſions of the baſe line A C and B C, to the points of diſtance D and E, and between the rays A C and B C, you will have your deſire; as appears from the figure. But here ariſes a difficulty, namely, how to fill the vacant ſpace B B and G I, A A and H F, with the ſame ſquares; for it is ſuppoſed the baſe line cannot be prolonged any farther. On ſuch occaſion, take the meaſure of one of the ſquares, as G K, on the line F G, and ſet it off on the ſame line H I as often as it will go, and you will have the points L M N O P Q and R, through which drawing lines to the point of diſtance, you will have the ſame ſquares as before; ſuch are thoſe here marked with dots. The ſame method of ſetting off the meaſures on the line of depth, will be exemplified in other pavements hereafter.

To exhibit the perſpective of a Pavement of Squares *encompaſſed with a* Liſt *or* Fillet.

THE method of managing this ſecond pavement with a band around it, is the ſame with that of ſingle ſquares viewed in front; I ſhall therefore decline to waſte any time in teaching it, ſince I have already given ſo many figures thereof. It may be proper, however, to add, that the baſe line is to be divided into unequal parts, as A, B and C, becauſe of the fillets, and lines to be drawn from all theſe diviſions to the point of ſight D, and through the points where theſe are interſected by the diagonals A E, and G F, parallels to the baſe line are to be drawn. By this very plain operation will be produced the appearance of the pavement ſhewn in the oppoſite figure.

4


31
D
C
E
H
F
K G L M N O P Q R I
A
B
B
F
D
E
A B C G
31

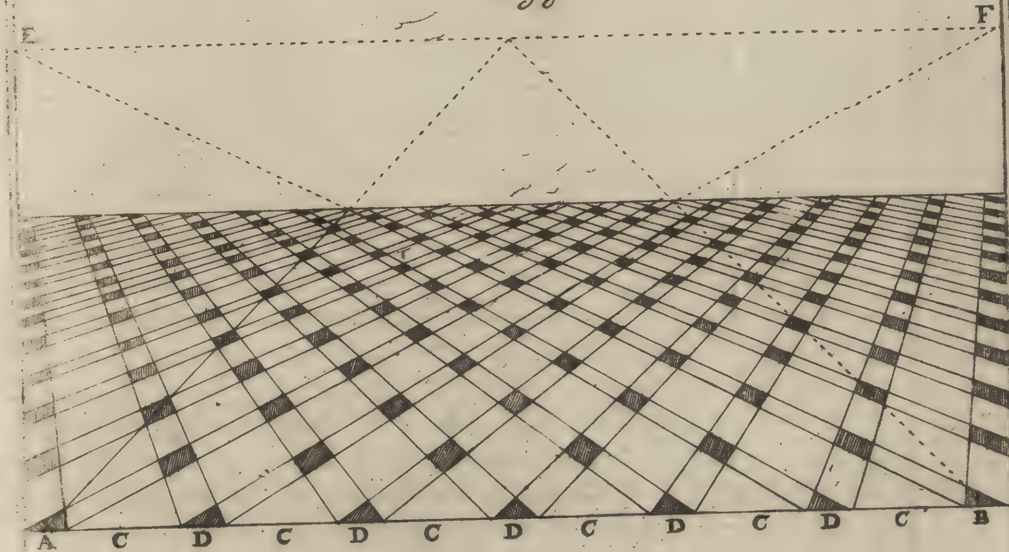
To exhibit the perſpective appearance of Pavements *viewed angle-wiſe, encompaſſed with a band or fillet.*

FOR ſuch kind of PAVEMENT, the baſe line A B is to be divided into unequal parts, the largeſt whereof are to be for the ſquares, and the ſmaller for the band or fillet; and from all theſe diviſions, lines are to be drawn to the points of diſtance E F, As has been already directed in ſingle ſquares.

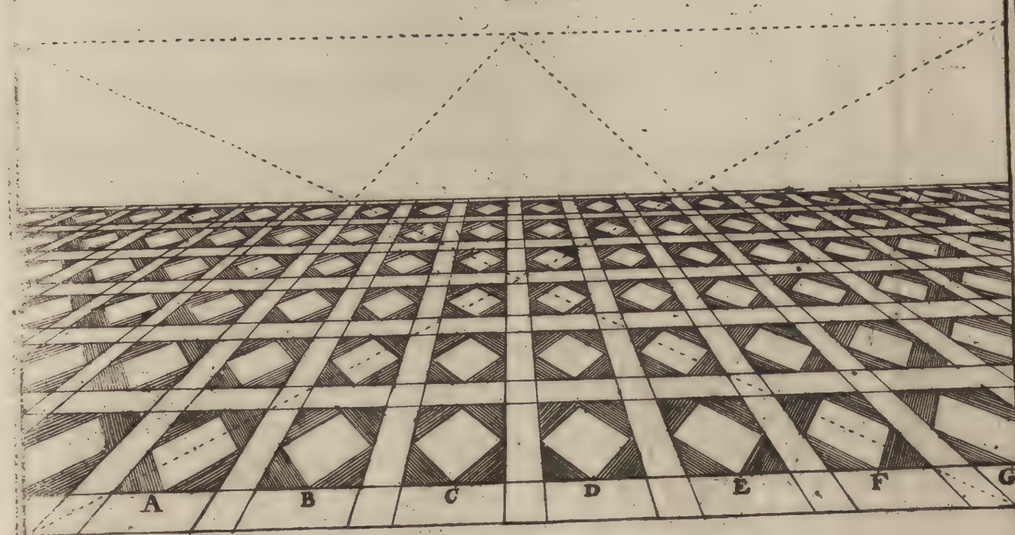
To exhibit the perſpective appearance of Pavements *of* Squares *viewed in front, encompaſſed with bands, or fillets, whoſe ſquares are divided by the angle.*

FOR this fourth kind of pavement, the ſame method is to be taken as in the ſecond, by ſetting the meaſures of the firſt range of ſquares and fillets on the baſe line, and from thoſe points to draw the lines according to former directions. Then to make the inner ſquares which are ſeen angle-wiſe, nothing more is required than to biſect the loweſt ſide of each ſquare of the firſt range, and from thoſe points, as A, B, C, D, E, F, G, draw lines to the two points of diſtance, and their interſections with one another will produce the ſeveral inner ſquares or lozenges throughout the plan.

1 fig.



2 fig.



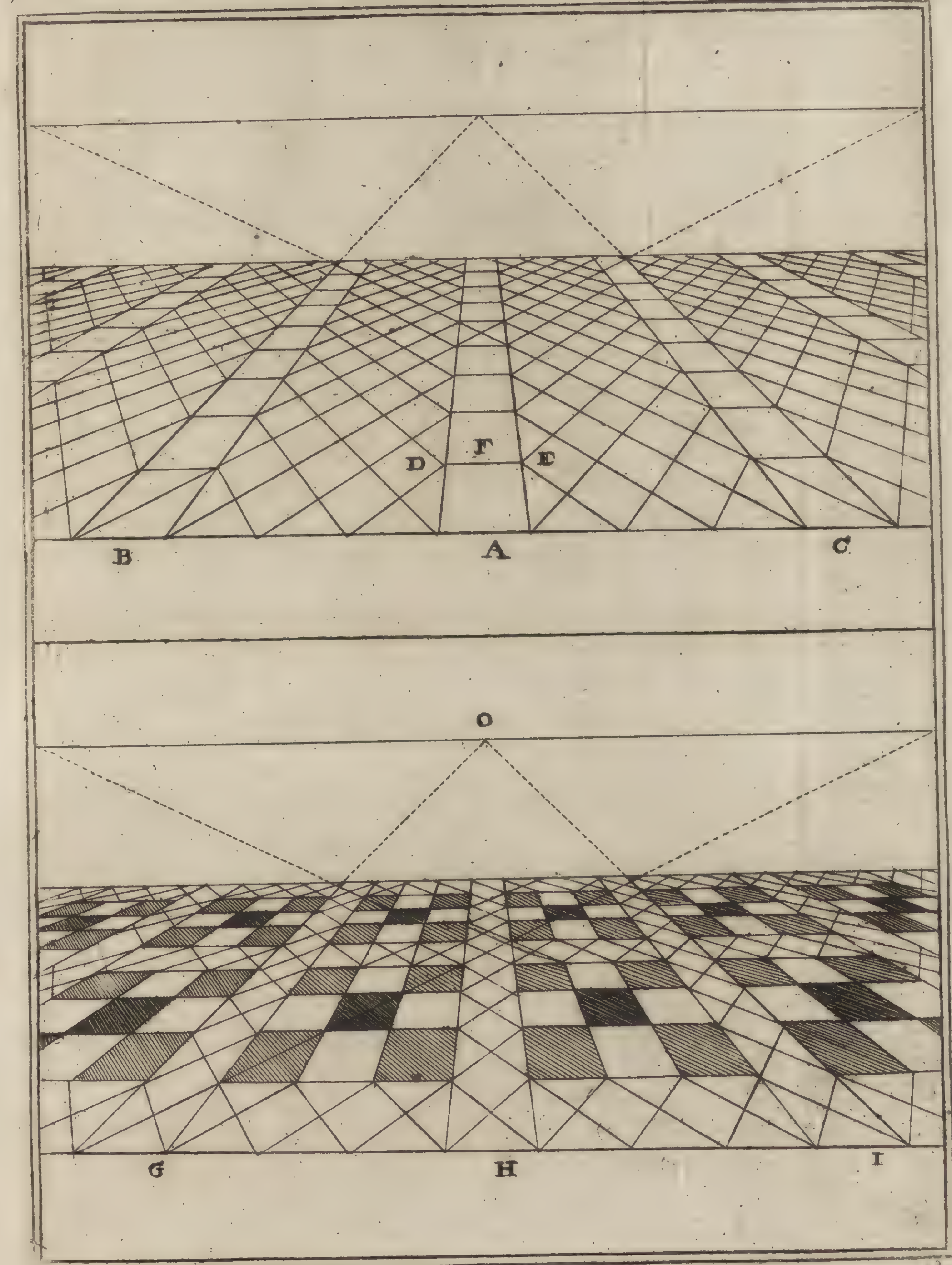
To exhibit a pavement *of* Squares *viewed angle-wise, with* chains *of* Squares *seen in front.*

I Shall suppose the perspective, or diminution of the square, by drawing the line of depth, to be already done, that I may save the trouble of too frequent repetitions in the ensuing pavements.

To manage this fifth sort of pavement, divide the base line into equal parts, to answer the number of squares, and from the points of the squares to be divided in front, as A B C, draw lines directly to the point of sight, and from the points of those to be seen obliquely, draw lines to the points of distance, but without marking them through the chains. After all the squares which are thus viewed by the angle are drawn, the squares of the chains will be easily formed by parallels from the opposite angles of the oblique squares on either side. As for example, from the angle D and E draw the parallel line F, and so for all the rest, as is shewn by the figure. Care is still to be taken, that there be always the same number of squares between the chains; as here we have three between A B. The measures on the base line, rightly laid down, will prevent any error of that kind.

To exhibit a pavement *of* Squares *in front, with* chains *of* Squares *angle-wise.*

THIS sixth sort of pavement is performed much after the manner of the preceding, by dividing the base line into equal parts, according to the number of squares, and from the points of divisions drawing lines to the point of sight, to form the bands or chains G H I; yet somewhat more in it, care being taken to make the cross there is, of the same breadth as the others that tend to the point of sight O, and that there be the same number of squares between the vacuities. The rest is obvious enough.


D
F
E
B
A
C
O
G
H
I

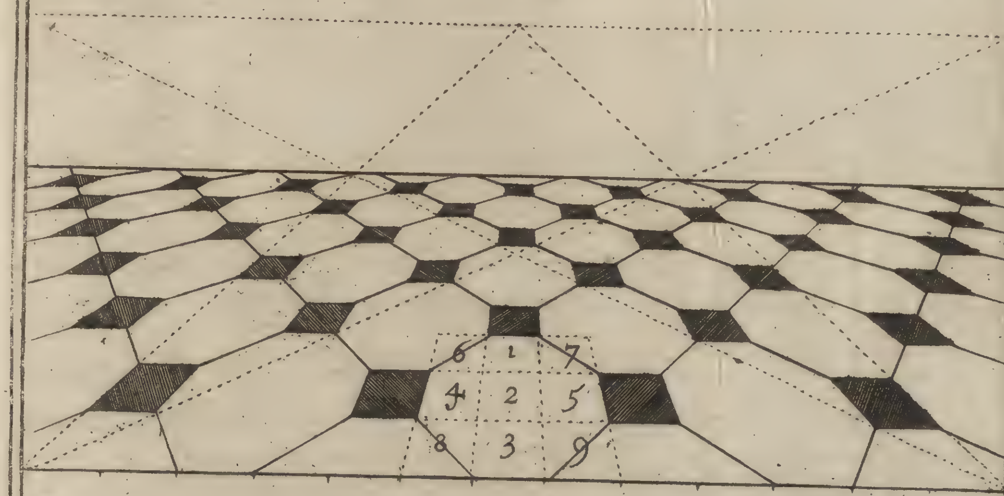
To exhibit a pavement *of* Octagons *intermixed with* Squares.

I ſhould never have done, was I to give all the varieties of pavements: invention would find endleſs employment in their conſtruction. This ſeventh inſtance is obvious enough; all I add it for, is to open the mind, and furniſh occaſion for the contriving of others. All that is required to produce this kind of pavement, is to divide the baſe line into a number of parts equal to the number of ſquares to be formed, as has been already directed. Of which ſquares a certain number is to be taken, as here nine, five whereof are full, and the reſt only halves; the full ones give the inſide of the figure 1 2 3 4 5, and the diagonals of the reſt, 6 7 8 9, give the ſides: the reſt is evident.

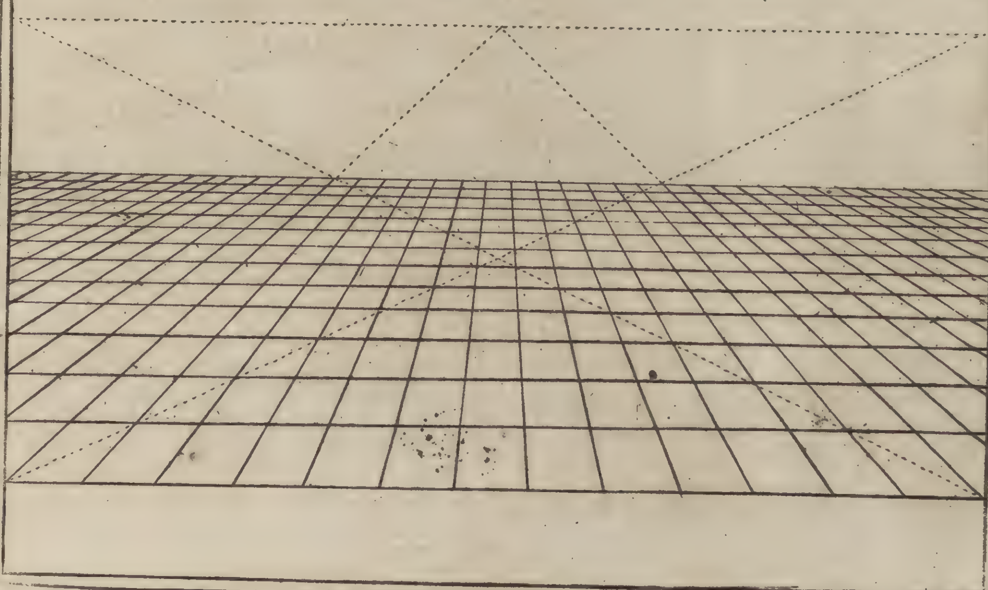
To exhibit a pavement *of* ſingle Squares *viewed in front.*

THIS form I have put the laſt, not as being the moſt difficult, for in reality it is the eaſieſt of all, and the very beginning of perſpective, but to intimate that it is the moſt uſeful and neceſſary; the others being ſeldom added but by way of ornament, and this ſerving as the foundation whereon any ſolid is to be raiſed, and the elevated parts made appear. As will be ſhewn hereafter.

1. fig.



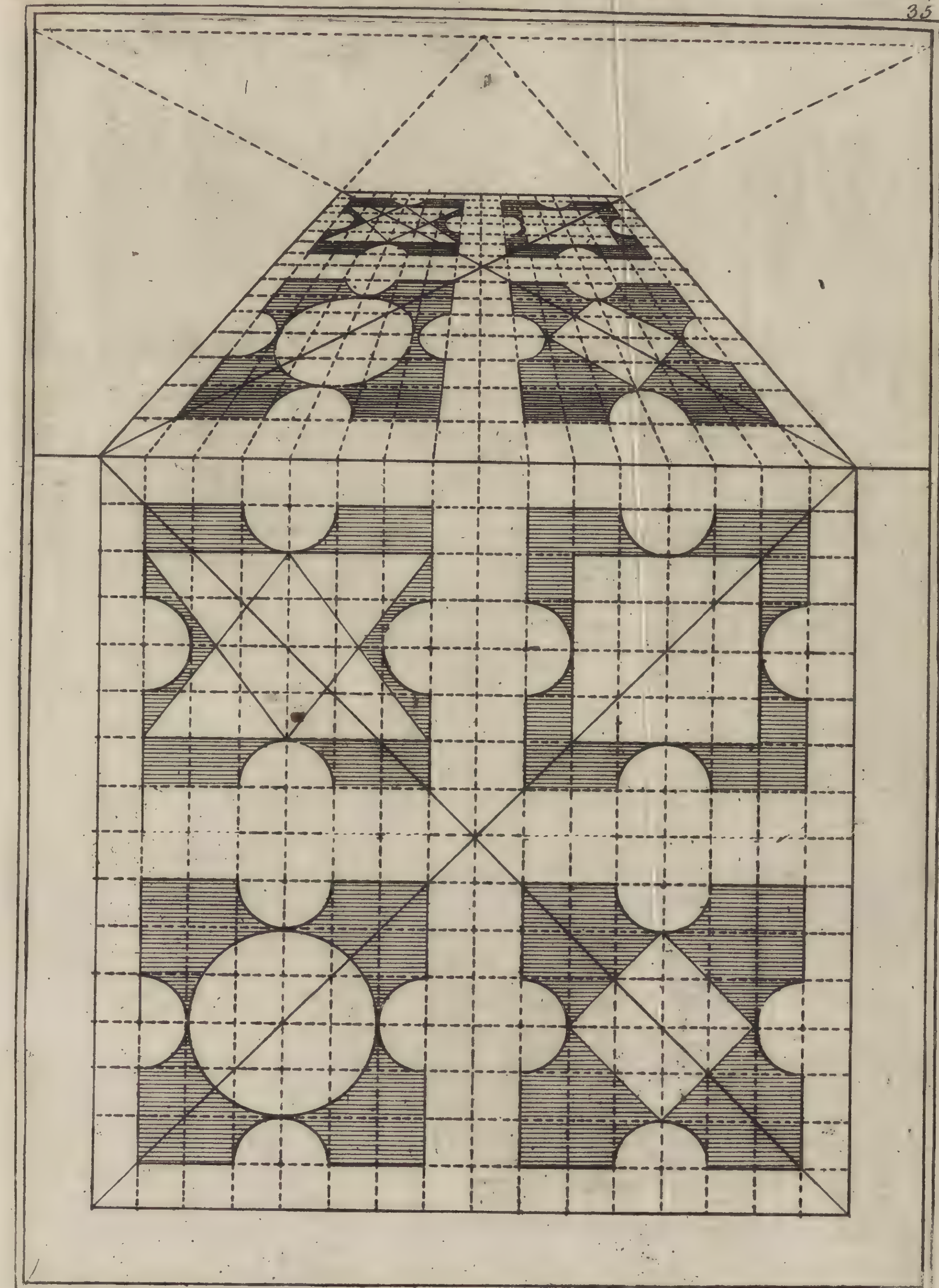
2 fig.



Plan *of a* GARDEN *in perſpective.*

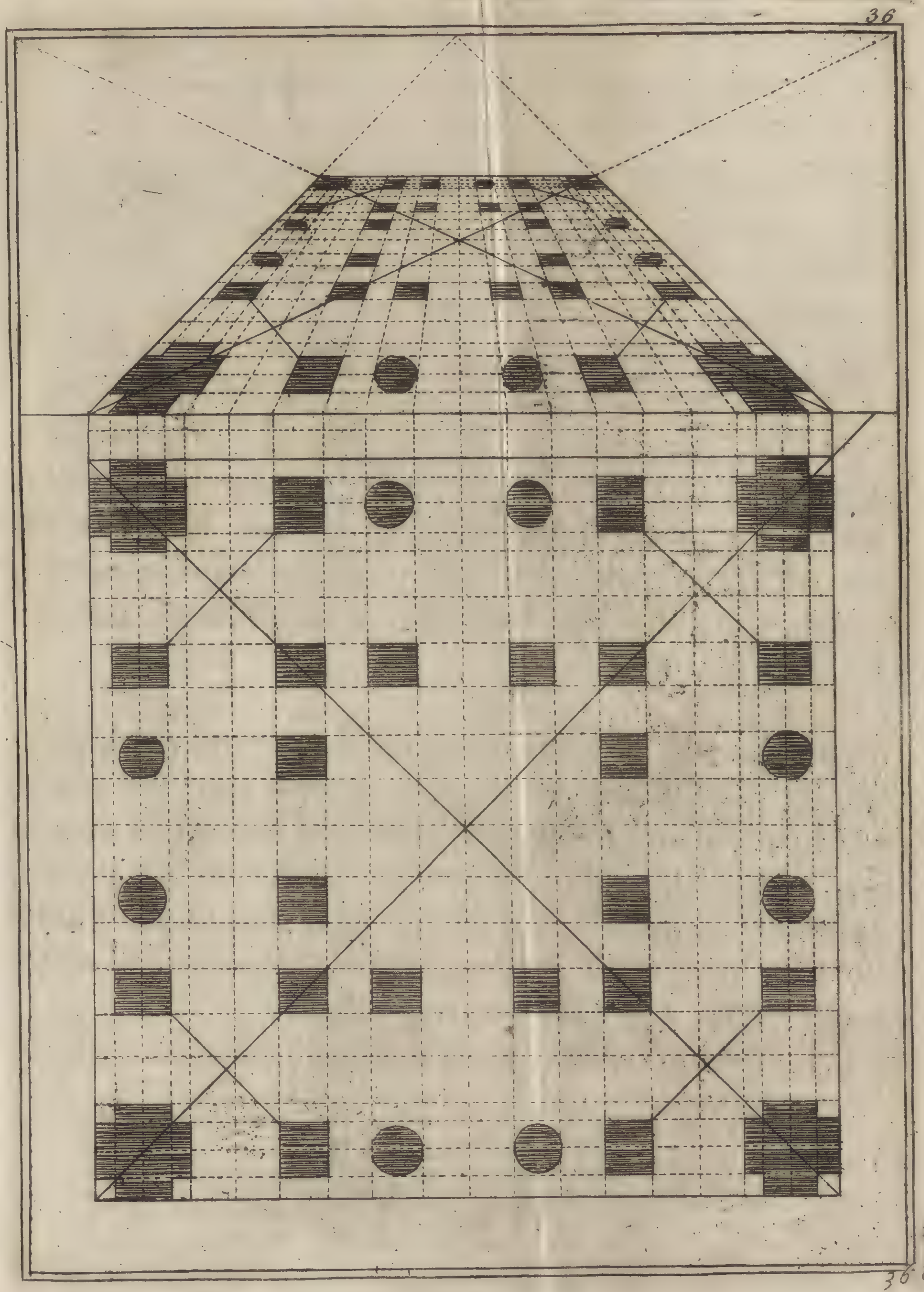
WHAT we have been obſerving, is confirmed by this plan, which ſhews with what facility the projection is made by the foregoing rules. For, drawing lines from all the diviſions on the baſe line to the point of ſight, the diagonals will give the depth of the whole plan, and the diminution of all the little ſquares. Laſtly, marking the walks, borders, and figures of the geometrical plan in the correſponding ſquare of the projected plane, the whole parterre will be found in perſpective.

Let the plan given you to put in perſpective, be of what ſort ſoever, the readieſt way will be to draw a ſquare about it, and divide that into ſeveral leſſer ſquares. For after the grand ſquare, with all the leſſer ones, are projected by the ordinary rules, you have nothing farther to do, but take care that every part is compriſed in the ſame number of little ſquares in the diminiſhed plan as in the geometrical one, and the figure of the one will be exactly found in the other.



Plan *of a* Building *in perſpective.*

SERLIO, in his treatiſe of PERSPECTIVE, ſets a great value on this method of putting plans in perſpective, as a thing of ſingular uſe in architecture, whereby a perſon is enabled to ſhew one part of a building raiſed, and the reſt in platform. But this method for exhibiting the projected plans of buildings, being the ſame with that I have already laid down for a garden, I need not ſay any thing farther thereof: the figure is ſufficient for the reſt. And from this one figure meaſures are eaſily taken for any other, either more eaſy or difficult ones.

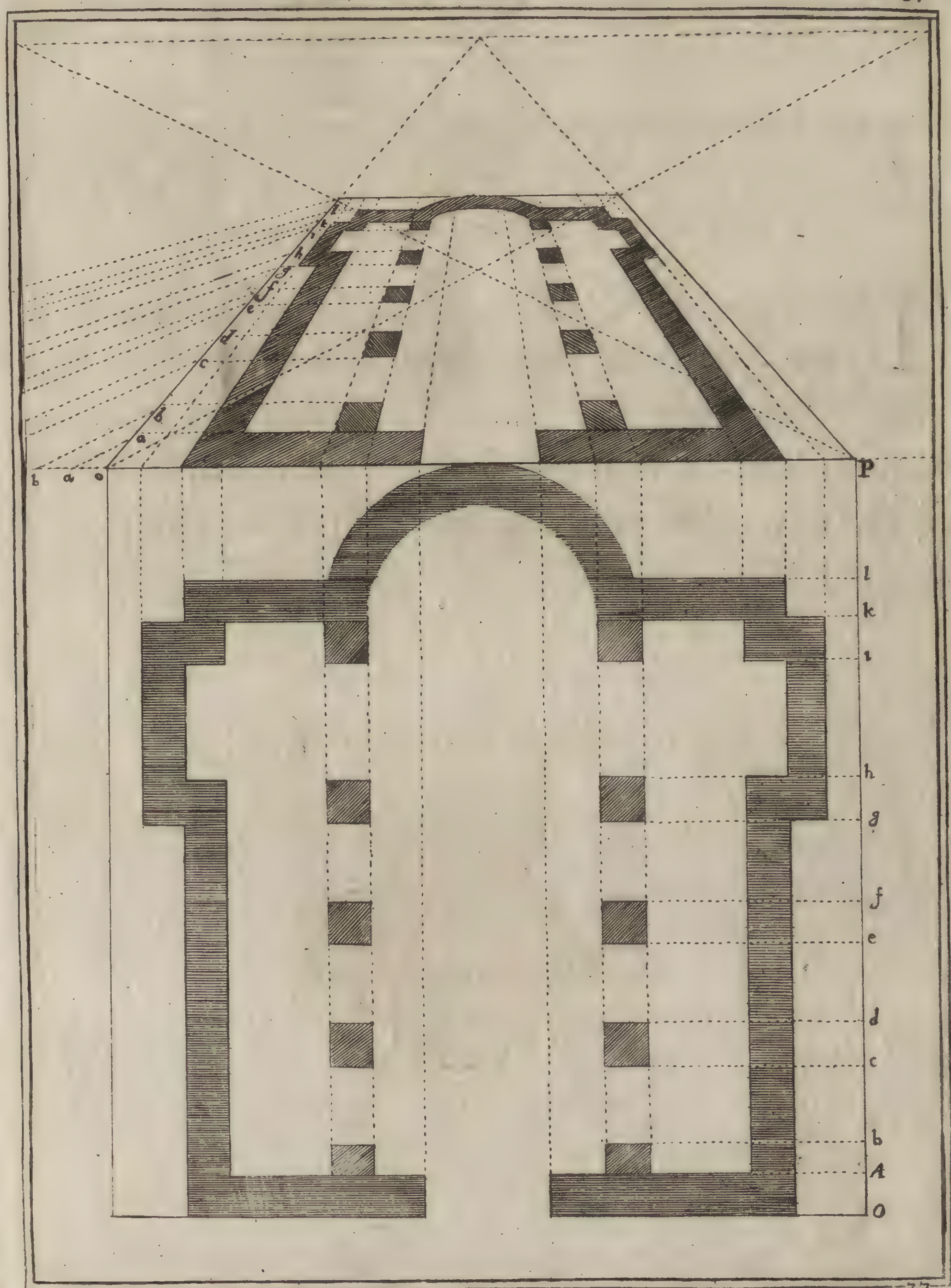


Plan *of a* CHURCH, *in perſpective.*

THIS plan is conducted according to *Obſervation* VII. page 18. That is, all the ſides perpendicular to the baſe line, as are here the places of the walls and pilaſters, are drawn to the baſe line, and from that line to the point of ſight; and all the other ſides parallel to the baſe line, as are here the breadths, *&c.* drawn to a line on one ſide, O P, which thus ſhews the points *abcdefghikl.* Theſe points transferred hence upon the baſe line as *a b*, &c. and lines drawn from them to the points of diſtance, their interſections with the extreme ray, give points for drawing parallels through, exhibiting the diminution of every thing: as ſhewn by *a*, *b*, *c*, &c.

This method of diminiſhing on the extreme ray is practiſed by many; and yet ſuch as would take my advice, ſhould let it alone, and rather follow the method directed in *Obſervation* VIII. where a perpendicular is raiſed on the end of the baſe to receive the interſections, and to obviate the defect of the preſent method, which does not diminiſh enough, unleſs where the points of diſtance are very remote: for in that caſe, the effect is the ſame as in the other methods.

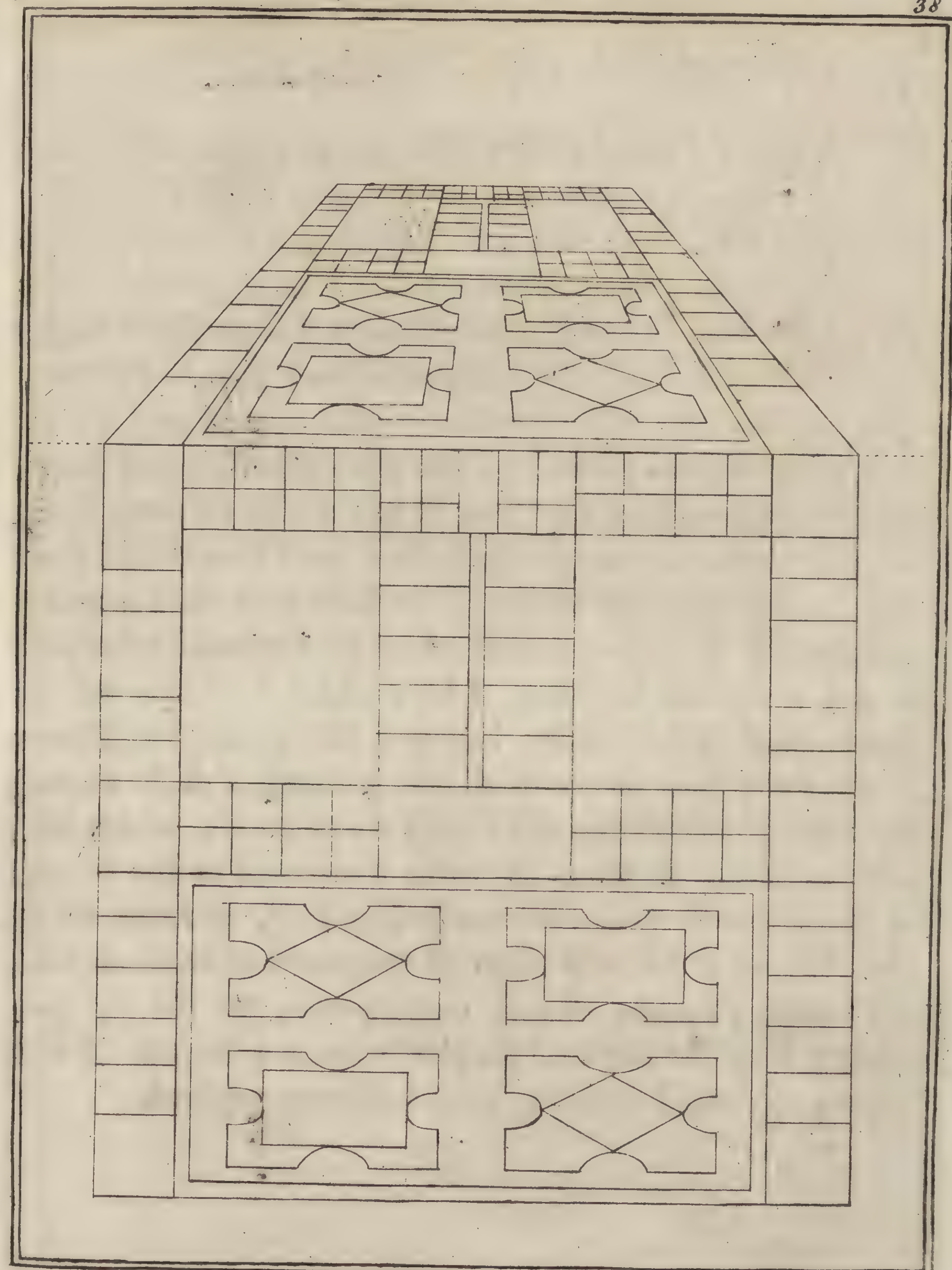
37



PLAN *of a* Houſe *with a* Garden.

THE method of putting this plan in perſpective, is the ſame with that of the garden alone; ſo that what is there ſaid may ſuffice for both. My deſign in putting it here, is to ſhew, that one may diminiſh all ſorts of plans, whether conſiſting of equal or unequal parts.

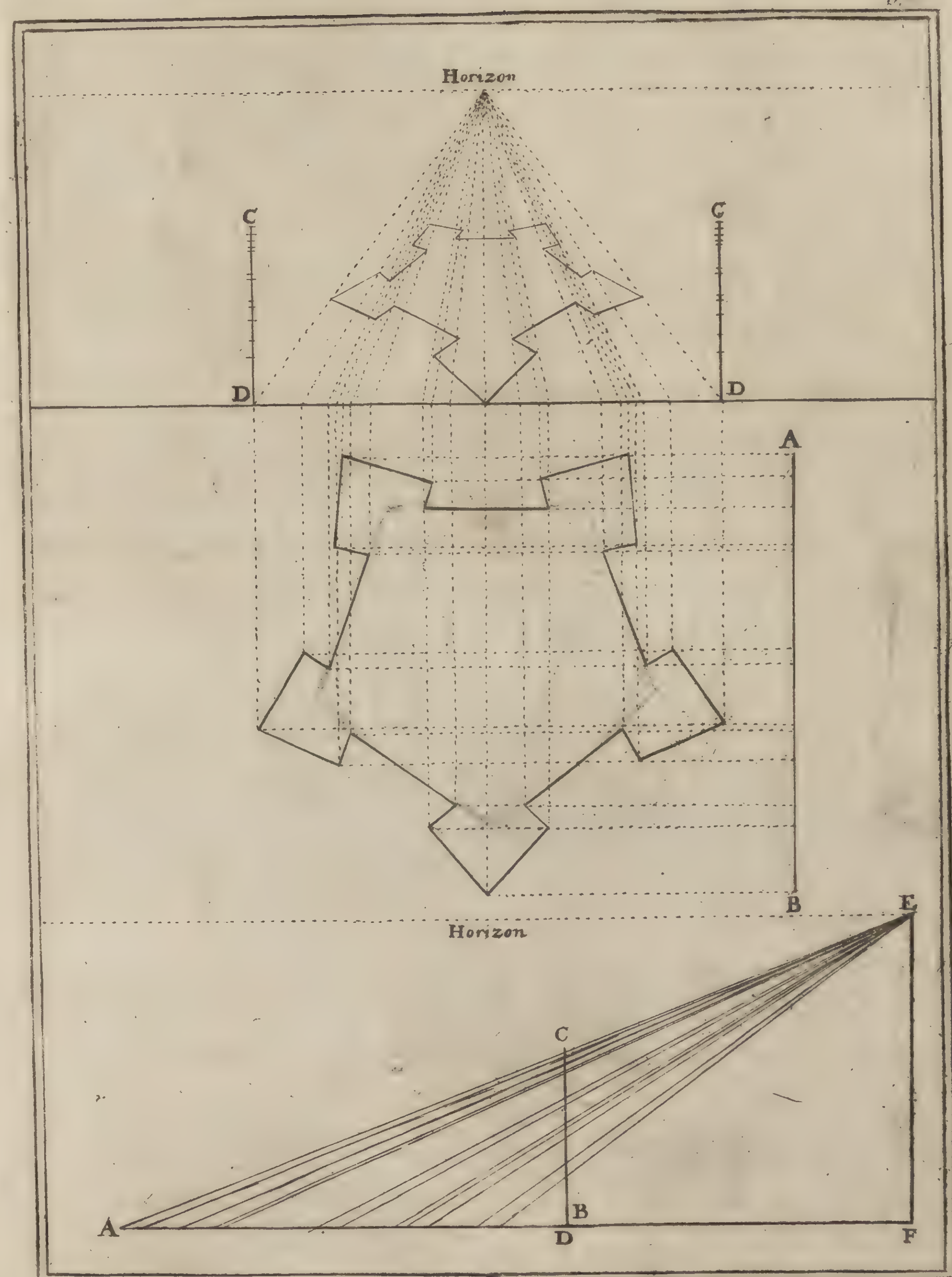
38



38

Plan *of a* FORTIFICATION *in perſpective.*

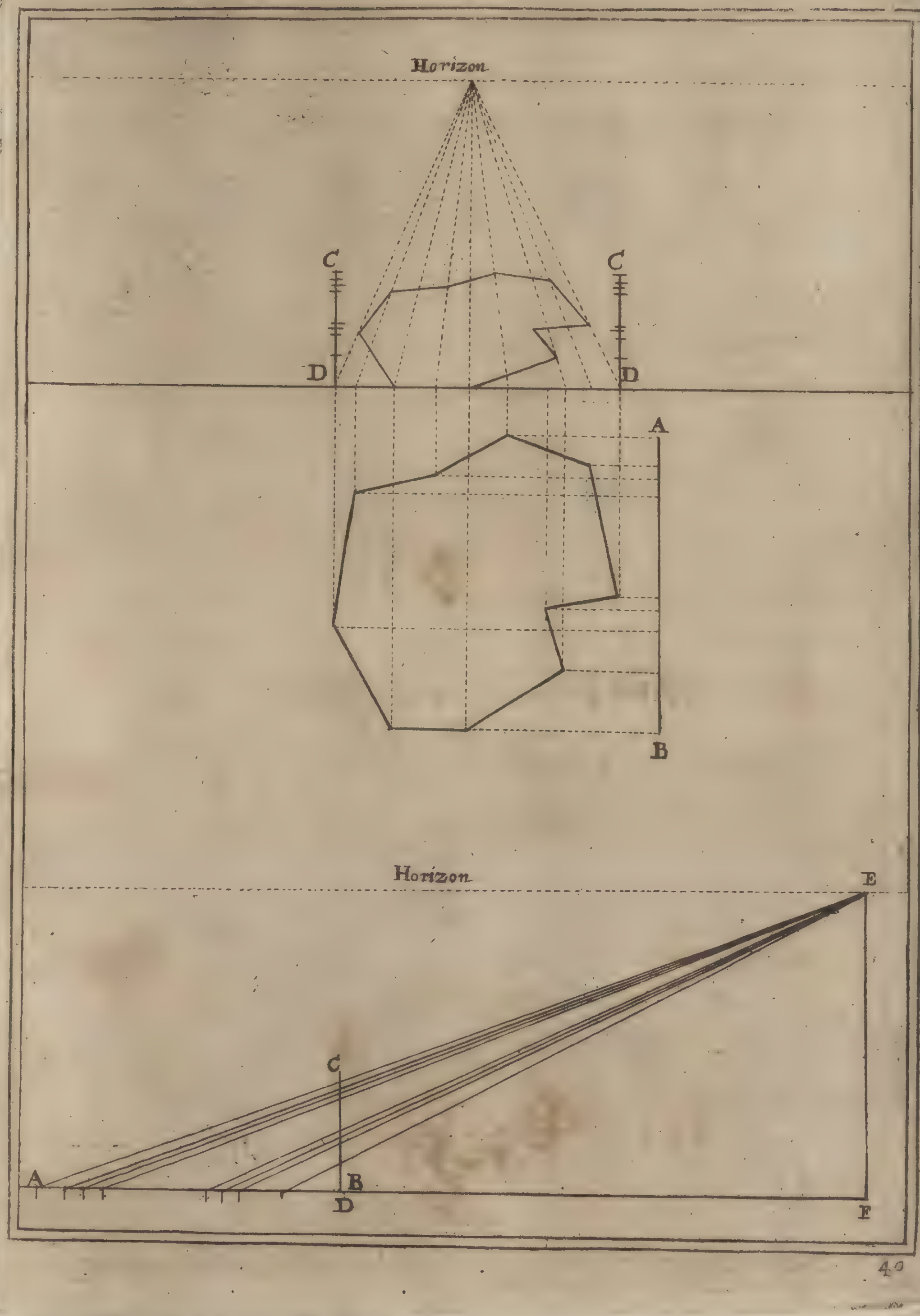
TO put a FORTIFICATION, or other plans of the like kind in perſpective, the VIIth and VIIIth *Obſervations*, page 18, are to be uſed. The ſame in effect is the method already laid down for the CHURCH and HOUSE, pages 37, 38, namely, by raiſing perpendiculars from all the angles to the baſe line, and producing rays from their interſections with the baſe line, to the point of ſight; and from the ſame angles drawing the parallels to the terreſtrial line, and marking the diviſions on a ſide line, A B. Theſe diviſions being transferred thence to the baſe line, and lines drawn from them to the point of diſtance, we ſhall have the line of interſections C D. But, becauſe there is not room on the plate to put it on the baſe line, I have added it underneath the figure, as in A B. Laſtly, having fixed the point of diſtance in E; draw lines thence to all the diviſions of A B, cutting the line of interſection C D in ſo many parts; which line, C D, with its diviſions, is to be transferred to the bottom of the extreme ray, in the perſpective plan, or rather ſet on each ſide, as D D; and from all the points of the lines D C, D C, draw parallels, or only mock-points, on the ray proceeding from the angle of the plan belonging thereto. Which points, connected by lines, give the figure required.


Horizon
C
C
D
D
A
B
E
Horizon
C
A
B
D
F

An irregular Plan *and* Figure *in* Perſpective.

WHOEVER can perform what is directed under the laſt article, will find no difficulty in projecting any other figure, that being the moſt intricate of all kinds of plans in perſpective. It was judged, however, proper to add ſome irregular form, which might appear at firſt ſight to be difficult, in order to ſhew that theſe rules are adapted to all the variety of poſſible figures, and that every form and ſhape, in whatever view or aſpect it is to be ſeen, may eaſily be projected in perſpective.

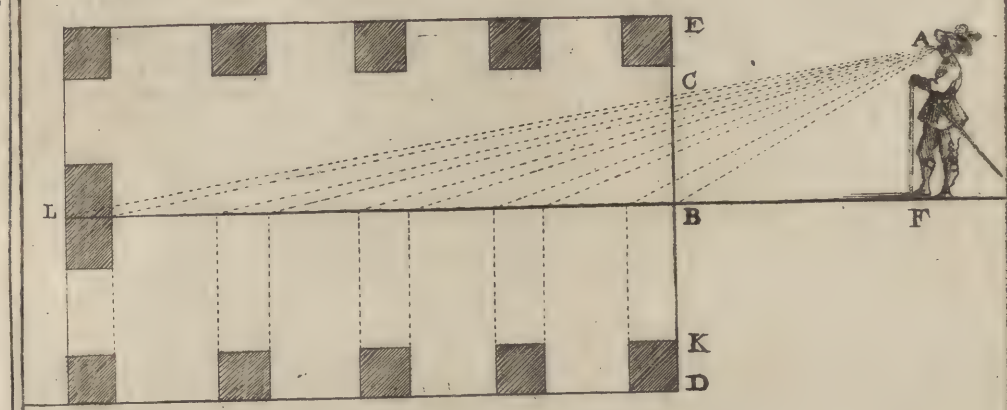
The lines in this plate are marked as in the former: to repeat the operation is needleſs.

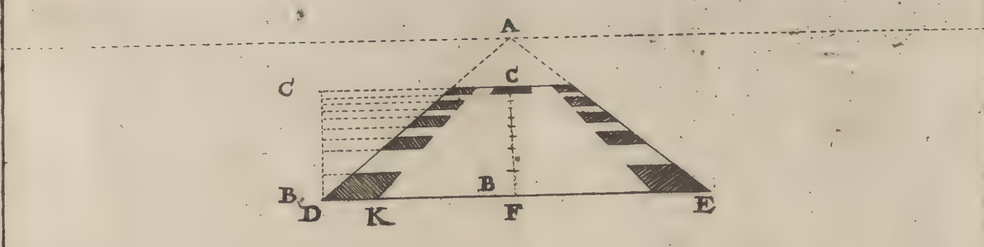

Horizon
C
C
D
D
A
B
Horizon
E
C
A
B
D
F

Another plan *of a* Church, *in Perſpective.*

THE manner of projecting the perſpective of this plan, ſhould ſeem very different from what I have hitherto delivered, by reaſon of its different diſpoſition; but that I own is a thing done deſignedly, to ſhew that though there be diverſe ways and manners of operation, they are all reducible to one. For this projection, in effect, is the ſame with what I have already preſcribed for fortifications, irregular figures, and other plans, with only this difference, that the parallels to the baſe line are there marked on a ſide line, and here, on a line in the middle of the plan. But the ſame effect is produced from each method; for drawing lines from all the diviſions of the middle line B L to the eye A, you will have the line of interſection B C, which is upon what may be called the baſe line D E.

To put the geometrical plan in perſpective, transfer the whole length of the terreſtrial line D E to any place at pleaſure, as D E in the perſpective plan, and ſet off the height of the eye A F; then, putting the line of interſection B C either in the middle, or on one ſide, draw parallels to the baſe line through all its diviſions to the extreme rays D A, E A, and ſet the breadth of the pilaſters D K on the baſe line; then drawing a line from K to the point of ſight A, the points wherein it interſects the parallel lines will be the widths of the pilaſters.


E
A
C
L
B
F
K
D


A
C
C
B
B
D
K
F
E

RULES

FOR

ELEVATIONS.

PART III.

Preliminary inſtructions *neceſſary to the following methods.*

THE reader is by this time ſufficiently inſtructed in what relates to Ichnography and Planigraphy, conſidered as the foundations of Orthography and Scenography.

Orthography, I have already defined to be the elevation of the fore-right plane or front of any object, the elevation of the face or front, &c. and Scenography the elevation of all the parts. See the DEFINITIONS, page 7.

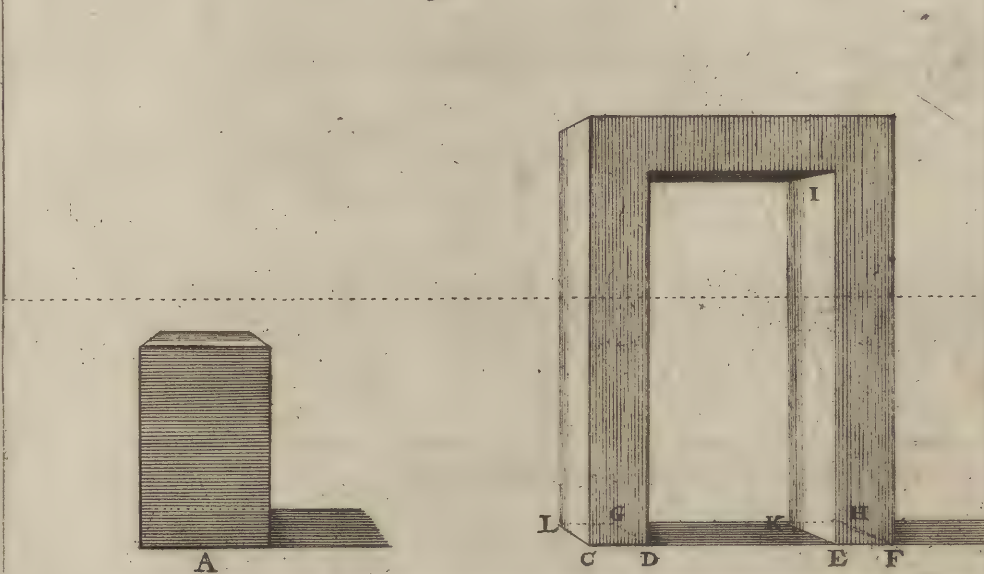
To make myſelf more intelligible to ſuch as are not verſed in the uſe of thoſe words, I purpoſe, as already promiſed, for the future to call Ichnography the *Plan*; the Orthography, the *Upright* or *Elevation* of the front; and Scenography, the *Elevation* of the whole.

Here it is to be obſerved, that elevations never give the eye all the angles of the plan, and that the quantity of ſides, or angles which appear to the eye, depends on the aſpect or view the object is taken in. Thus, if it be viewed in front, as the figure A, it will only ſhew one ſide, though the plan hath four. If it be viewed by the angle, it will ſhew two, as B; but never more, in whatever view it be taken. I ſpeak of ſquares; for as to objects of many ſides, they may ſhew three, four, five, and more.

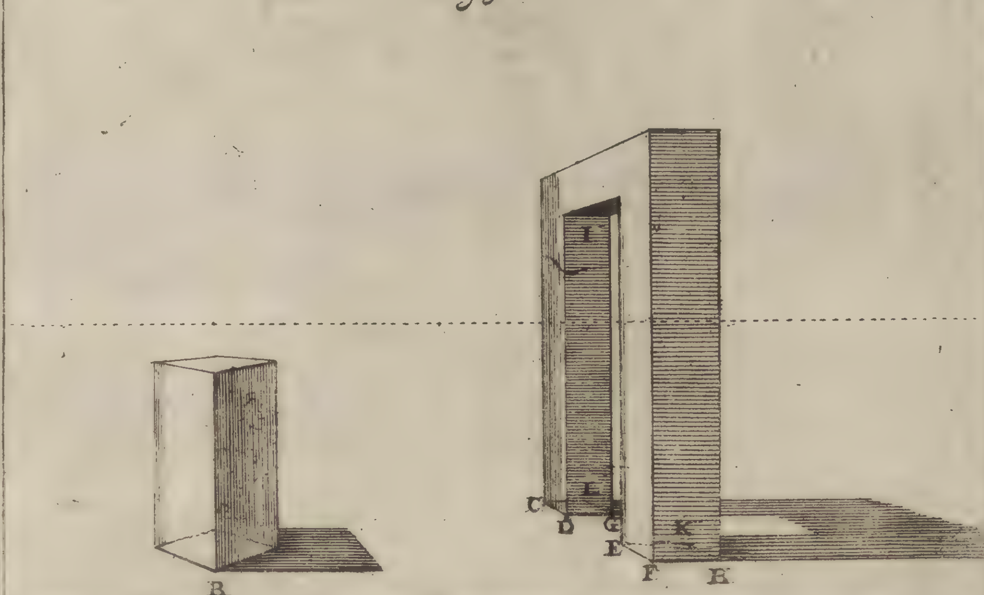
When objects decline ever ſo little from the point of view, they are ſeen by the angle, and of conſequence muſt ſhew two ſides. And ſtill the farther they are removed from the point of ſight, the more of the ſide they ſhew; thus the ſide K E ſhews more of itſelf than C L, though their thickneſs be equal.

Another thing to be obſerved is, that the lines which are parallel to the horizon when the object is viewed in front, as C D E F of the door in *Fig.* 1. become a viſual ray when the ſame object is viewed a little obliquely. Thus C D E F, which in the upper figure ſtands in front, becomes a viſual ray in that underneath. And, on the contrary, the lines which are rays in the upper, become parallel to the baſe in the under. As to perpendiculars, they always continue perpendiculars in whatever view the projected bodies are exhibited.

1. fig.



2. fig



Of the Line *of* ELEVATION, *serving to give the* Heights *of all Kinds of* Objects *in all Parts of the* Plan.

THE use of this line is of the last importance, insomuch, that whoever is perfectly master thereof, will scarce meet with any difficulty in raising any kind of elevation.

As in the putting planes in perspective we made use of the base line; so in elevations, another line is to be used to direct us, and carry the proper heights to all the objects to be raised.

This *line of elevation* must be perpendicular to the base line A B, which is always the first line of the plan, and that next the eye, and of consequence the fittest to carry the measures to the several objects in the plan. On this account the line of elevation C D, is raised perpendicularly on A B, as the other lines in the plan should be. Insomuch, that it is to be remembered as a rule, that whenever, in the course of this work, mention is made of perpendiculars, it is to be understood of perpendiculars to the base.

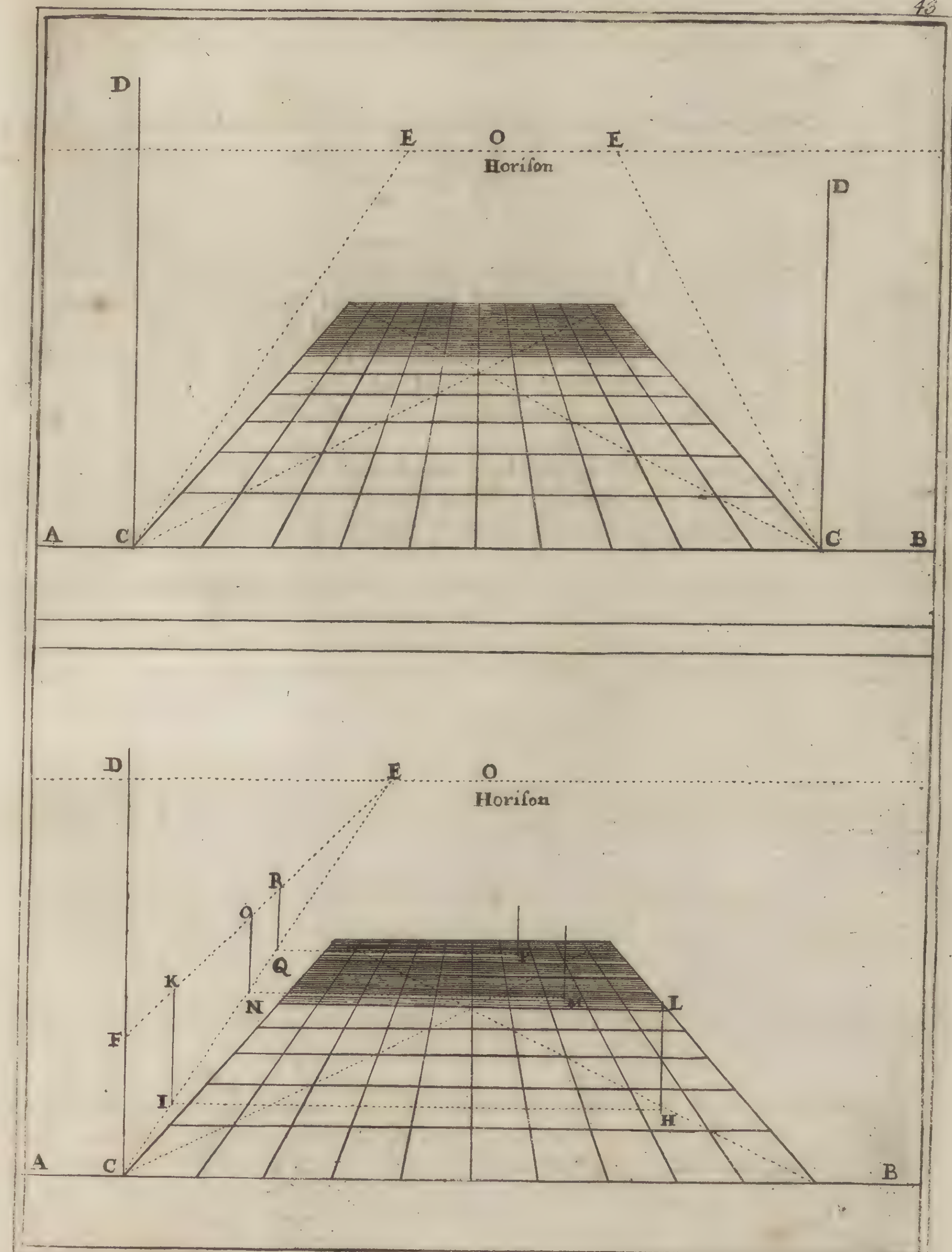
Since this line of elevation is to receive and give the heights of all objects to be raised on the plan, it must have the same horizon with the plan. Therefore, from the foot of this line (which is placed either on the right or left) a line is to be drawn to some part of the horizon, though what part does not matter, the effect being the same in all. In this figure, the line of elevation is C D, and from C the line is drawn to the point of the horizon in E; or it might be drawn to the point of sight, if one pleased. I have here put the line of elevation on either side, and the point different in each, to shew that it will answer any where.

If from the point H, which is in the plan of the second figure, you would raise a line of two feet height, set two equal parts on the line of elevation, which you hold equivalent each to one foot, such is here CF; and from C drawing a line to the point E, you will have an elevation of two feet between the two lines C and F.

Now, to give the same height of two feet to a line raised from the point H, from H draw an occult line parallel to the base line, till it meet the line C E in the point I; then from the point I erect a perpendicular I K; this will be the height of the line required, which is to be taken hence in the compasses, and set off from H to L.

If a line likewise two feet high were required to be drawn from the point M, the same operation being repeated, you will have the perpendicular N O, which will be the height required from M. Lastly, performing the same for the point P, you will have the perpendicular Q R for the height of a line of two feet from the point P.

The same rule will give a height of 3, 4, 5, 10 or 20 feet; all required being to set such heights on the line of elevation, from those heights to draw lines to the point in the horizon, as E, and to proceed with the rest as above.


D
E
O
E
Horison
D
A
C
C
B
D
E
O
Horison
R
O
Q
K
N
L
F
I
H
A
C
B

To exhibit the ELEVATION *of a* Cube *in* Perfpective.

HAVING projected the plan according to the preceding rules, and raifed the line of elevation as F L, fet off the height of the cube thereon, namely F M, and from thofe points F and M draw lines to the point of elevation E. From the feveral angles of the plan A B C D, draw parallels to the bafe line, till they meet with the line F E, and from the points of interfection F and H, erect perpendiculars F M and H K; then taking thofe meafures in your compaffes, fet them perpendicularly upon the angles of the plan; thus, taking the height F M, fet it on the two perpendiculars raifed from A and B, which will give you A G and B G; then taking the height H K, fet it on perpendiculars raifed from C and D, which will give you C O, D O; laftly, joining the right lines GO, O G, the cube will be raifed.

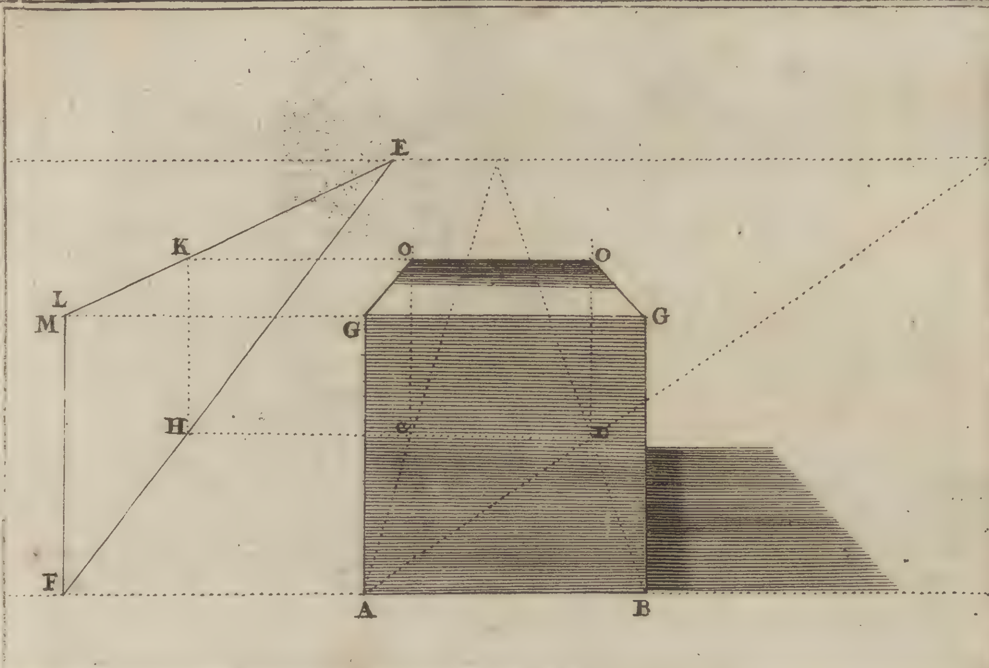
Or, if you draw parallels to the bafe line from M and K, their points of interfection with the perpendiculars A G, B G, C O, D O, will be the altitude of the cube, and thofe points connected by ftraight lines will complete its figure.

For the elevation of any figure whatever, always draw lines from the feveral angles of its plan, parallel to the bafe line, till they cut the line drawn from the foot of the line of elevation, and proceed in all refpects as directed for the cube, and you will find there is no figure however difficult and irregularly formed, but will be thus brought into its perfpective. Examples of which I fhall give in the polygons following.

The fecond figure is another cube, raifed after a fomewhat different manner from the firft. The procefs I fhall defcribe in few words, being nothing contemptible.

Having difpatched the plan the ordinary way, from the feveral angles thereof, B C D E, erect perpendiculars; and on the firft of them, B C, fet off the given height of the cube, namely B A, C A; then from the points A A draw lines to the point of fight F, or to the points of diftance G H, and the points I and L, wherein they interfect the perpendiculars of the angles D and E, will give the line of depth, and the top of the cube perfectly raifed.

This latter method is much lefs univerfal than the former, which has always been in ufe among the oldeft authors; yet has it fome advantages which I fhall have occafion to touch upon hereafter.


E
K
O
O
L
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G
G
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C
D
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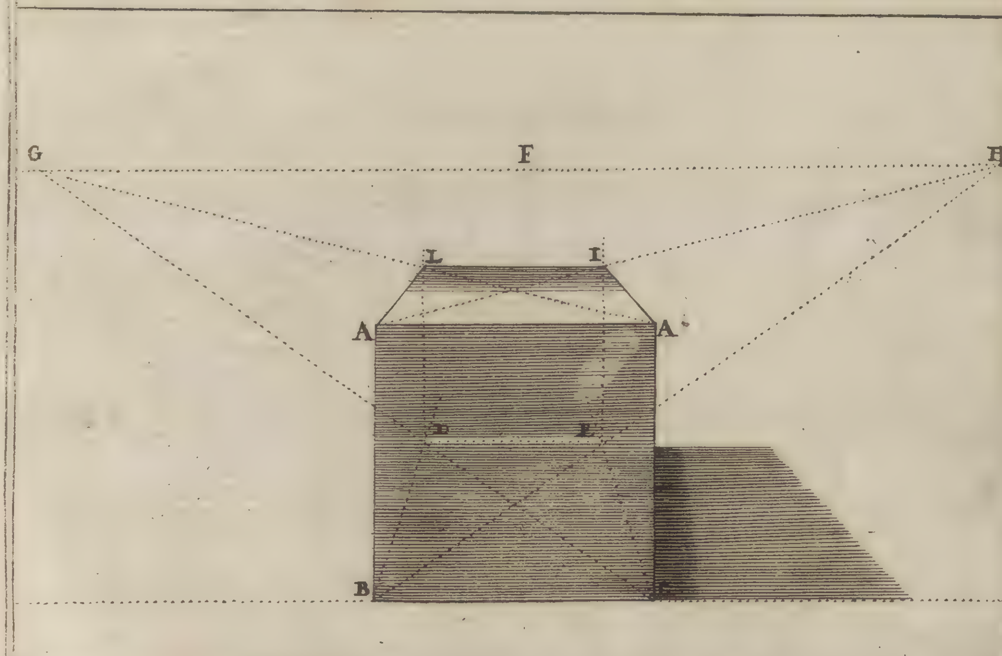

G
F
H
L
I
A
A
D
E
B
C

To find the Elevation *of a* TRIANGLE.

I Now proceed to ſhew with how much eaſe all kinds of figures may be raiſed in perſpective. Of theſe, polygons, or figures of many ſides, are the moſt difficult. I ſhall therefore chooſe to exemplify in theſe; and, to obſerve ſome order, will begin with the moſt ſimple, the TRIANGLE.

Having formed the plan, as already directed, page 21, where is ſhewn the method of drawing it with a ledge or liſt; the line of Elevation, as juſt now intimated, muſt be ſet on one ſide, and of any height at pleaſure, for example B A, which we ſuppoſe to be three feet; then from all the angles of the plan drawing parallel lines, parallel to the baſe line, to the line B E, and from the points of interſection erecting perpendiculars between the lines A E and B E, ſet off all their heights upon the ſeveral angles, whence the parallels proceed. The height A B for inſtance, on the angles C and D, which will give C R and D S, the height N P on the angle Q, which will give Q Y. Then for the inner angles, ſet F I on G and O which will give G T and O V, and N L ſet on K will give K K. Laſtly, connecting the points R, S and Y, and again the points T, V and X, by right lines, you will have the triangle in its proper thickneſs, *&c.*

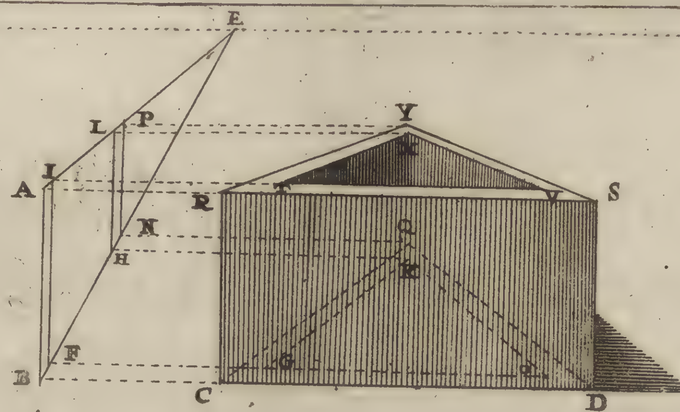
By drawing lines parallel to the baſe line, from the points A I L P, the points of their interſection with the perpendiculars raiſed from the angles of the plan, will give the angles of its elevation.

To exhibit a PENTAGON, *or* Five-angle, *in perſpective.*

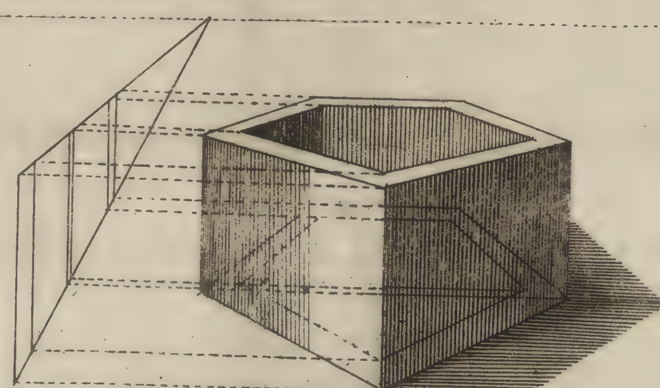
THE PENTAGON, I have ſaid, is a figure with five ſides, and as many angles; and have directed the method of forming its projection, page 22. As to the making its elevation, I ſhould loſe time to deſcribe it, the figure hereto annexed, with the lines drawn from its angles, and from the perpendiculars of its altitude, ſhewing abundantly that its method is the ſame with that of the cube and triangle.

To exhibit the elevation of a HEXAGON, *or* Six-angle, *in perſpective.*

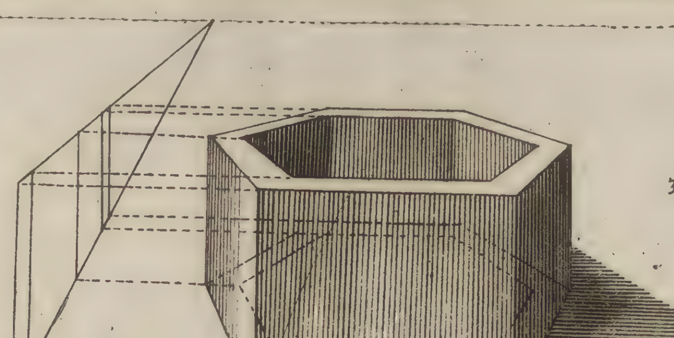
THE HEXAGON is a figure with ſix angles, and as many ſides or faces, as already obſerved, pages 23, and 27. where I have given its diminution. The method of raiſing it is obvious enough from the figure.



1.fig



2.fig



3.fig

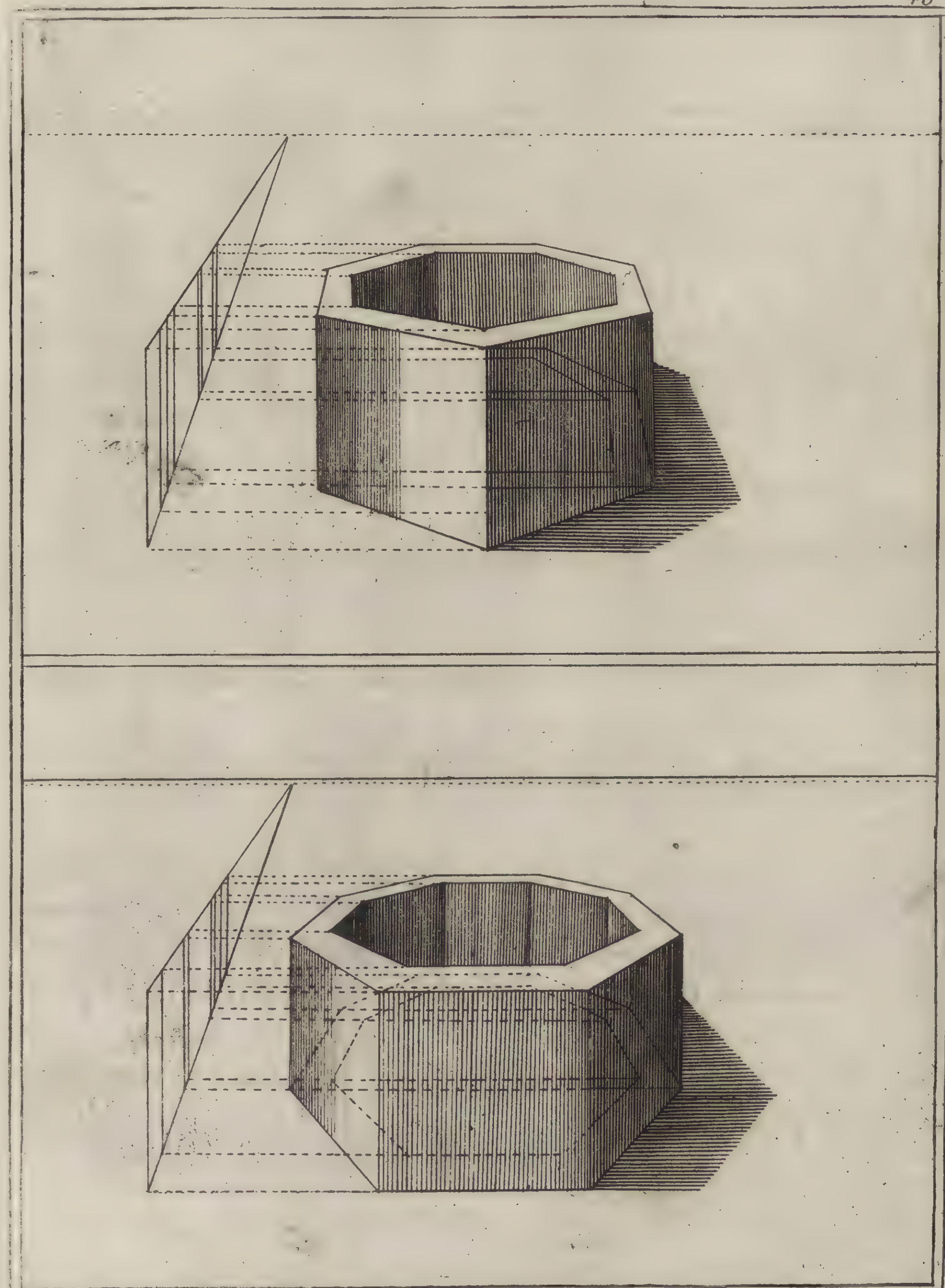
The HEPTAGON, *or* Seven-Angle, *in* perſpective.

THE HEPTAGON is a figure with ſeven ſides and angles; the manner of deſcribing it, and of putting its plan in perſpective, I have already given in page 24. Its elevation is performed after the ſame manner as that of the triangle, as appears from *Fig.* I.

The OCTAGON, *or* Eight-Angle, *in* perſpective.

THE OCTAGON is a figure with eight ſides and as many angles, as repreſented in pages 25, 26. where the reader will find different ways of putting the plan in perſpective. Its elevation is to be procured in the ſame manner as that of the preceding object.

46



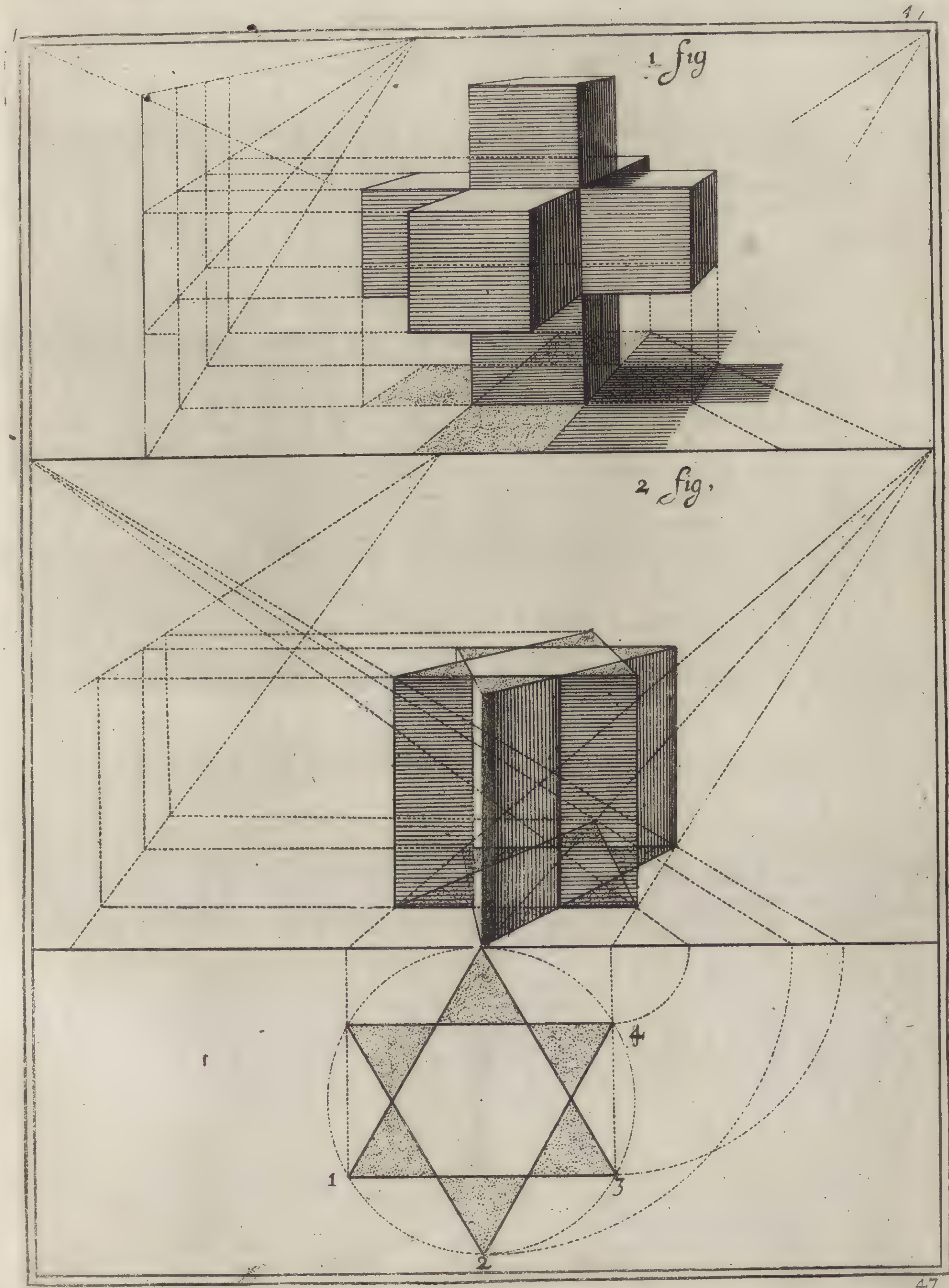
46

A Double Crofs *in perfpective.*

THIS and the following figure I add from the Sieur de *Maralois*, who has given them a place in his works according to the method I have already laid down. The truth is, it would be fomewhat difficult to put them in perfpective any other way, by reafon of the multiplicity of their angles; but in this method all is eafy, by only raifing the heights from all the angles of the plan, *&c.* as already obferved of polygons, and is evident from the figure.

A Stone fluted, *or* channeled ftar-wife, *in perfpective.*

NOT having given the plan of this figure among the other plans, I have judged proper to add it underneath. The geometrical plan is eafily made, as being only a circle whofe periphery is divided into fix parts and the divifions joined by right lines, leaving a point between each two; as, for example, between 1 and 3, leaving 2; and from 2 to 4, leaving 3; and fo of the other. The reft is obvious from the fecond figure.


1 fig
2 fig.
4
1
3
2
47

To exhibit PILASTERS *in perſpective.*

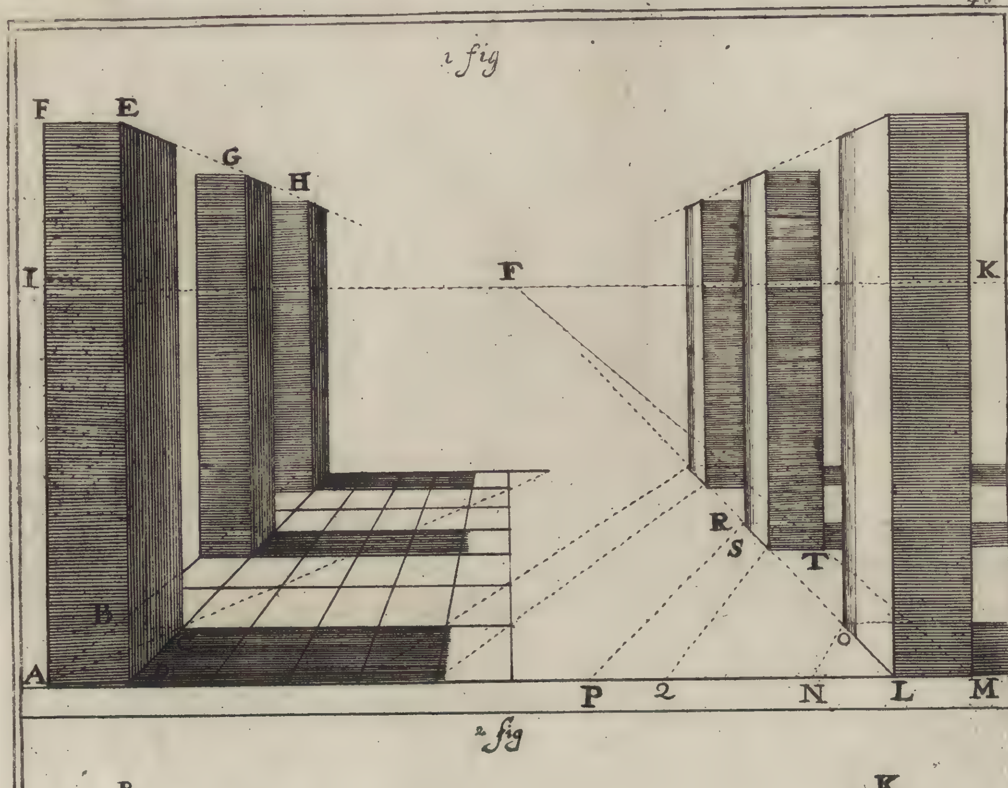
IN the raiſing of columns, pilaſters, walls, or the like objects, which are to be of the ſame height, there is no need of a line of elevation; it is ſufficient to proceed as in the ſecond method for the cube, page 44, that is, having raiſed perpendiculars from the angles of the plan, as here from A B C D of *Fig.* 1. ſet the height deſired on the firſt or ſecond perpendiculars, as A F or D E; then drawing a line from E to the point of ſight F, to this line all the perpendiculars from the angles from the inner ſide of the pilaſters are to be raiſed. In which caſe, the pilaſters G and H will have equal altitudes to the firſt.

If one chooſe not to make uſe of ſquares in the plan, the meaſures muſt be laid on the baſe line, and rays be drawn thence to the point of ſight F, and other rays for the diminutions to the point of diſtance K. Thus, for example, L M being a ſide of a pilaſter, rays are to be drawn from the two points thereof, L and M, to the point of ſight F, for the breadths of all the pilaſters; and for the depth of each, as they are intended to be ſquare, the diſtance L M is to be taken and ſet off from L to N; then drawing a line to K, it will give the depth of the pilaſter in O; laſtly, from the points L M O erect perpendiculars, and proceed as above directed. If you would have the width of two pilaſters between one and another, ſet them accordingly on the baſe line, and after making the depth of the ſecond pilaſter equal to the firſt, as here P Q, from the two points P Q draw lines to the point of diſtance K, which will give the points R S on the ray L; and from S draw another ſhort parallel S T, cutting the ray M F; laſtly, from the three points R, S and T, erecting perpendiculars, proceed as in the former caſe. A third and fourth pilaſter, &c. are to be added after the ſame manner, ſtill obſerving the ſame meaſures on the baſe line as in the firſt figure.

To exhibit PILASTERS *viewed by the angle.*

I HAVE already obſerved, page 17, that the plan of ſquares is formed by drawing lines from the diviſions of the baſe line to the point or diſtance. As to the elevations, the method is the ſame with that juſt deſcribed. For having ſet the height A B on the firſt perpendicular, lines muſt be drawn from the point B to the points of diſtance C D, which will interſect and give the heights of the other perpendiculars raiſed on each ſide. Then giving the diſtances required between the two pilaſters, which are two ſquares, raiſe the ſecond; and by the ſame rule the third. Their heights will be found by drawing a viſual ray from the point B to the point of ſight E, the interſections whereof with the firſt perpendiculars in the points F and F, as alſo the interſections of other lines from F and F to the points of diſtance C and D with the other perpendiculars, will give the heights required, as in the firſt pilaſter.

Theſe pilaſters which are raiſed without plans, muſt have their meaſures on the baſe line, as if they were to have the ſame breadth with thoſe viewed in front. Accordingly, the breadth G H muſt be marked, and a ray be drawn from G to the point of ſight E, which will give all the middle points, or diameters. Then ſetting the ſame breadth from G to I, from the three points G H I draw lines to the points of diſtance C D, which form the firſt plan. On this plan erect perpendiculars, on the firſt whereof ſet off the height, as G K, and from the point K draw lines to the points of diſtance, which will give the ſhortnings of the perpendiculars of each ſide. For the ſecond pilaſter, do the ſame with the points L and M: and for the third, with the points N O. The reſt is evident from the figure.


1 fig
F
E
G
H
I
F
K
B
A
R
S
T
P
2
N
L
M
2 fig
B
F
F
K
C
E
D
A
O
L
M
H

Effect *of the* Difference *of* Horizons.

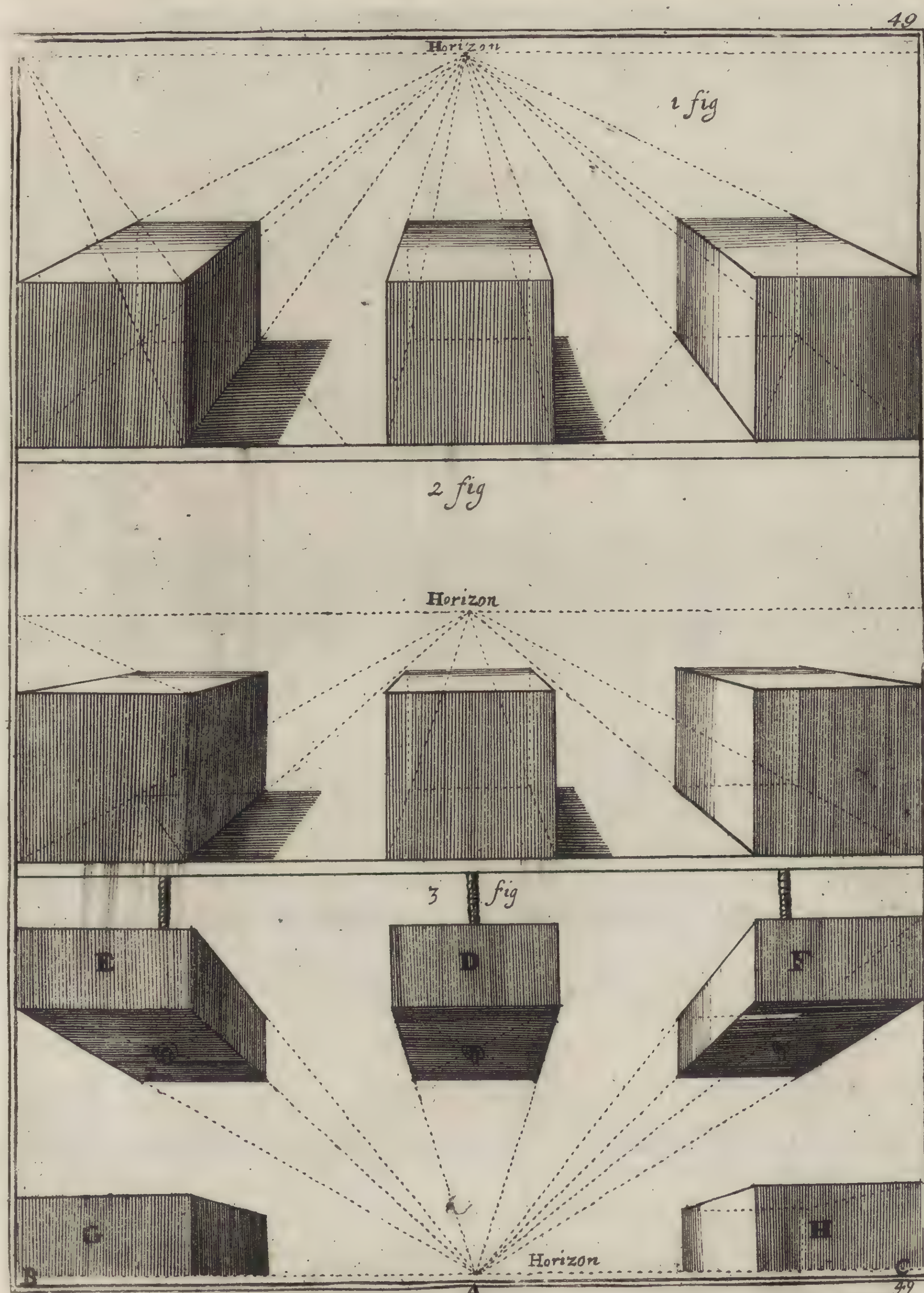
THE higher a man is raiſed above an object, the more he ſees of the upper part thereof; of conſequence the lower he is, the leſs he ſees; and if he be underneath it, he only ſees the bottom part, and nothing of the top.

The firſt propoſition is evident from *Fig*. 1. the ſecond from *Fig*. 2. and the third from the laſt.

The firſt and ſecond cubes are formed after the manner already delivered. The third are alſo produced by the ſame rules, though they may appear ſomewhat more difficult, by reaſon the object is ſeen overhead; but inverting the paper, or painting, and drawing lines to the point of ſight A, and points of diſtance B and C, as in the former methods, you will have the ſame facility in exhibiting them. I ſay nothing of objects viewed ſide-wiſe, as having ſo often repeated, that the method is the ſame as thoſe in front. To render the practice of putting them in perſpective more eaſy, I have added in the next plate two figures, the one a bare out-line, the other ſhadowed farther.

Before we quit this third figure, it is to be obſerved, that the lowneſs of the horizon is the reaſon we ſee the bottoms of objects, as D E F, whereas of the two others, GH, placed in the horizon, neither top nor bottom can be ſeen. Not the top, by reaſon of the lowneſs of the horizon; nor the bottom, becauſe they are the horizon itſelf.

There are abundance of painters faulty in this point, inconſiderately ſhewing the tops of objects, even where the horizon is very low.


49
Horizon
1 fig
2 fig
Horizon
3 fig
E
D
F
G
H
Horizon
B
A
C
49

Elevation *of* Objects *viewed by the Angle.*

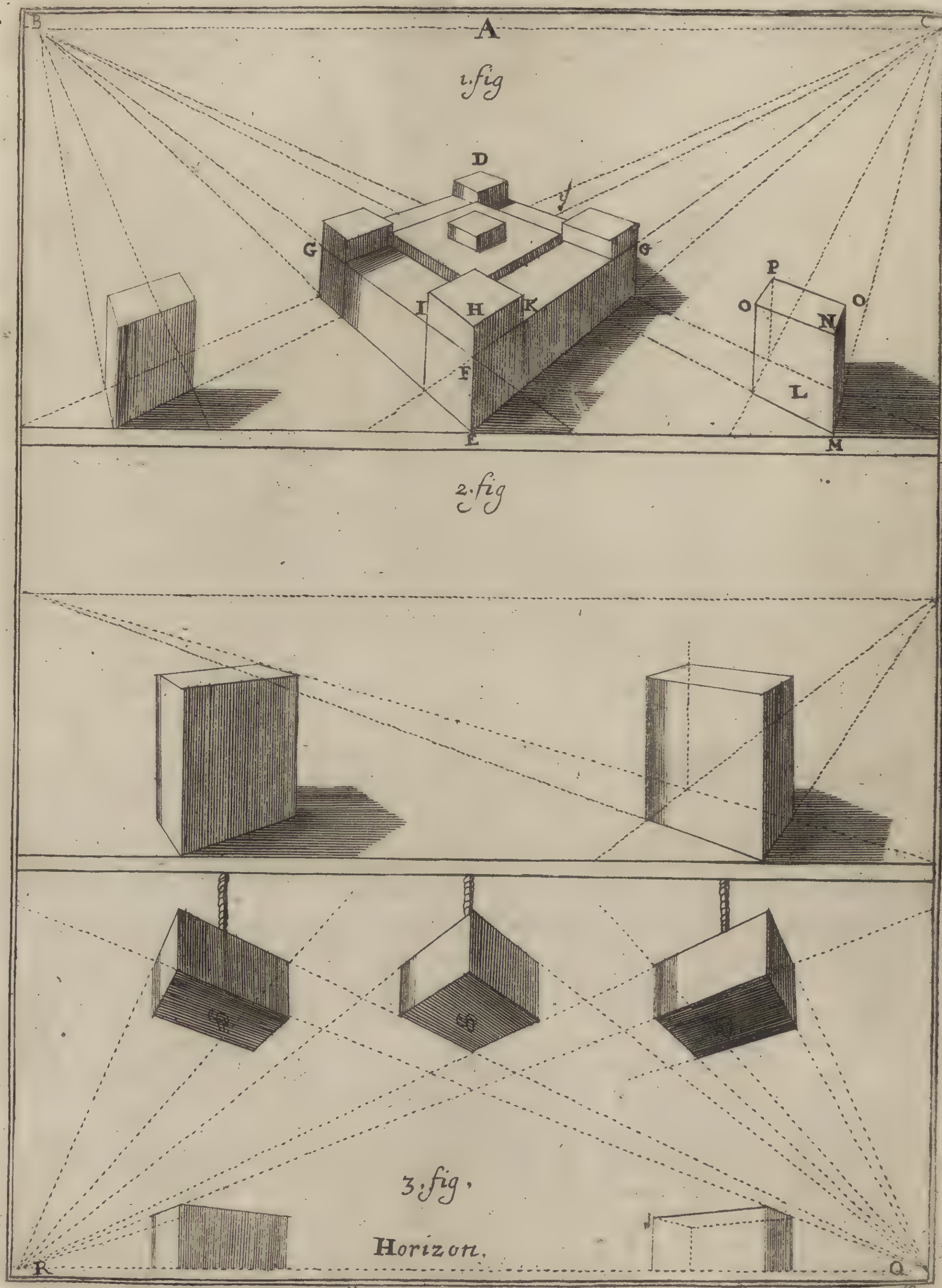
I HAVE ſhewn in pages 19, 20. that in the projection of oblique plans, the lines are always to be drawn to the point of diſtance, not to the point of ſight, unleſs for finding the diameter. The ſame rule is to be obſerved in raiſing the elevations, as is evident from the firſt figures, all the lines whereof are drawn towards the points of diſtance B and C, and none of them to the point of ſight A.

The firſt figure D ſhews that though there be a multiplicity of parts in any object ſeen angle-wiſe, they are all to be drawn to the points of diſtance B and C. To perform the operation, the rule is this; having projected a plan, and raiſed occult perpendiculars, as already directed, ſet the given height on the firſt angle, as E F, and from F draw lines to the points of diſtance B C, for the heights of the ſecond and third angles, in the points of interſection G G, then from G G draw lines to B and C, and you will have the fourth angle of the platform. The other leſſer pieces are raiſed after the ſame manner, namely, by ſetting the heights on the firſt perpendicular, as from F to H; and from H drawing lines to the points C and B, as before done from the point F. By ſuch means you will have the heights of all the angles, and the points I and K will give the thickneſſes of all the leſſer pieces, and the platform of the middle, by ſtill continuing to draw lines to the points B and C. The reſt is evident from the figure, which may ſerve for a caſtle defended with four ſquare towers, or for a palace cantoned with four pavilions.

The two other objects on each ſide the great one are ſeen ſide-wiſe; the manner of drawing them is in all reſpects like thoſe viewed in front. Thus, raiſing perpendiculars from all the angles of the plan L, and giving the neceſſary height to the firſt of them, as M N, and drawing a line from the point N to the points of diſtance B C, you will have the ſecond and third angles in the points of interſection O O; then drawing lines from O to the points B C, you will have the fourth angle, which is the elevation of the whole. This is according to the firſt method; the ſecond would have given the ſame.

The ſecond figure underneath is produced the ſame way; all the difference is, that in this the horizon is ſomewhat lower.

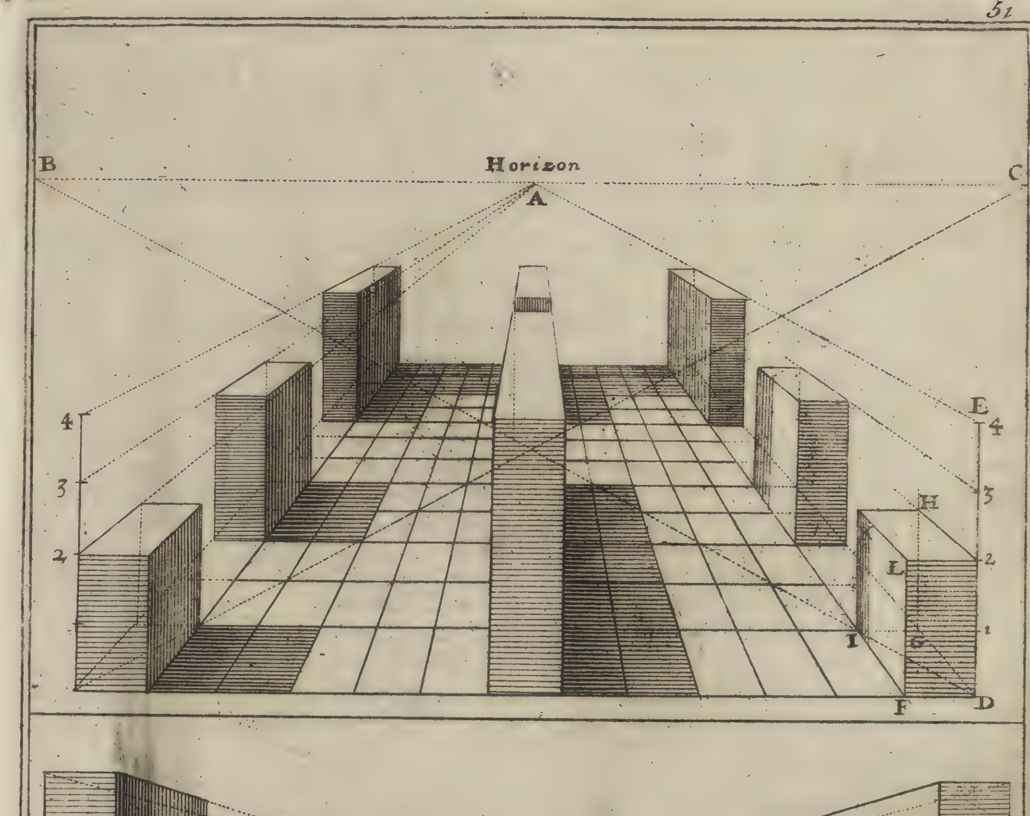
The third ſhews the bottom of the objects; but the method is ſtill the ſame as in thoſe that ſhew the tops, the lines being drawn to the points of diſtance Q R in the horizontal line.


A
B
C
1. fig
D
f
G
G
P
O
O
N
I
H
K
F
L
E
M
2. fig
3. fig.
Horizon.
R
Q
50

To raise objects of any heights, and remove them to any distance at pleasure.

SUPPOSE it be required to have an object two feet high, one foot broad, and one foot deep; and another three feet high, one foot broad, two feet deep, and two feet distant from the first object; and another a foot broad, five feet deep, four feet high, and three feet distant from the middle object; your method of proceeding will be thus. Having formed a plan of squares, supposed each equivalent to one foot, by means of the points of sight A, and distance B C; from the first angle D erect a perpendicular according to the second method, page 48, which perpendicular is to carry the proper measures to all the objects, as here D E, wherein the measure D F, is set four times, by reason the highest object is not to exceed four feet. From the several angles of the first square F I G D erect occult perpendiculars; and having set the proper measure, namely two feet, on the first of them, D, from the point 2 draw a line to the point of sight A, and it will cut the perpendicular of the angle G in the point H, through which a line is to be drawn parallel to the base, cutting the perpendicular of the angle I in K, and another parallel to be drawn through the point 2, cutting the perpendicular of the angle F in the point L; then connecting the four points H K L and 2, by right lines, you will have the first object. Now as you would have a space of two feet between the first and second object, two squares are to be left vacant between them; and on the first angles of the third, perpendiculars are to be raised, and the same operation performed as to the first object, with this difference, that the height of the second is to be taken from the third point of the line D E, by reason it is to be three feet high, and that it must take up two squares, since it is to be two feet deep. B tween this second and the third object the space of three squares is to be left, by reason there is to be three feet distance from the one to the other. From the first angles of the fourth square perpendiculars are to be raised as for the first object, and five squares farther, another perpendicular for the line of the depth, and the bound of the five feet, which is the depth of this third object. The fourth point of the line D E gives its height, four feet, by cutting the perpendiculars, as in the first object. The objects on the other side are raised in the same manner, and on the same proportions as these; but the wall in the middle is of an equal height every where, namely, three feet, with an aperture of four feet in the middle.

In the second figure are three walls of equal height; whereof that in the middle is a square deeper than the two extreme ones. Between each is an aperture of three feet, for doors or windows. On the other side is a continued wall fourteen feet long, and of an height answerable to the rest. The method of elevating all these, is the same with those above. What we call a wall may likewise serve for a hedge, palisade, *&c.* of a garden.


51
Horizon
B
C
A
E
4
3
2
H
L
I
G
1
F
D
Horizon
51

Of WALLS *viewed in Front.*

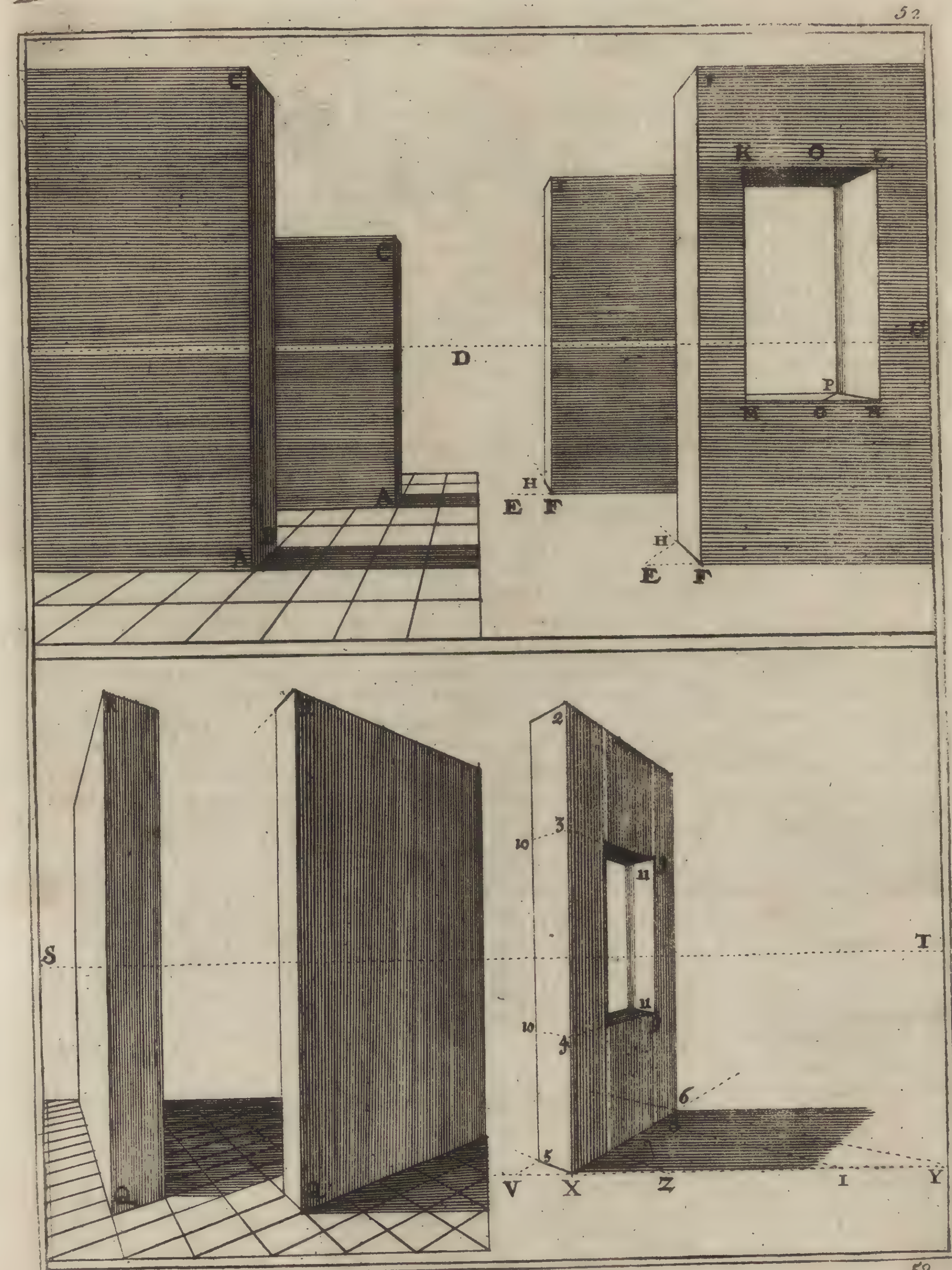
FROM what has been ſaid one may raiſe walls of all kinds in any oblique views; and though the ſame method may ſerve for the ſame walls viewed in front, I have thought proper to add this figure on two accounts: *1ſt*, by reaſon it is not always that plans are made, and on ſuch occaſion a man would be a little to ſeek for the thickneſſes. *2dly*, To give the thickneſſes to gates and windows, which might occur in ſuch walls.

To make walls parallel to the baſe line, or the horizon, on a plan, one may give them any length at pleaſure on the parallels to the horizon. To adjuſt their breadth, you may take that of a ſquare, from the angles whereof A B, you are to erect perpendiculars to any height, as C; from C draw a ray to the point of ſight D, and C D will give the diminution of the wall.

When there is no plan, the thickneſs of the wall, as E F, is to be ſet on a parallel to the baſe line in the firſt corner of the wall; then from F a line is to be drawn to the point of ſight D, and from E, another to the point of diſtance G; and from the interſection of the two in the point H, a perpendicular to be raiſed, and another from the point F. Then the height of the wall F I is to be taken, and from I a line to be drawn to the point of ſight D, the interſection whereof with the perpendicular H, will give the diminution of the wall. For the length, you may give it at pleaſure on the firſt parallel E F. For the doors and windows, in the ſame walls, mark the width and height as here K L M N, and ſet the thickneſs required on a parallel, either above or below the doors or windows, in the corner next the point of diſtance, as here N O or L O; laſtly, from the points L and N draw lines to the point of ſight D, and from the points O to the point of diſtance G, and from the interſections of thoſe lines in P, *&c.* draw the thickneſſes.

Other WALLS *viewed by the Angle.*

WHEN the wall is to be raiſed on a plan, you have nothing to do but erect perpendiculars from the angles already determined, and to mark the heights on the perpendicular from the angle next you, as on the line Q R; and from the point R, to draw lines to the points of diſtance S T; the interſections thoſe lines make, with the perpendiculars raiſed from the angles of the plan, will give the length and thickneſs of the wall. If you have no plan, ſet the meaſures both of the breadth and depth of doors and windows on the baſe line, as in this example, V X is the breadth, X Y the depth, and Z I the height of a window; then from all theſe points draw lines to the points of diſtance S T; firſt from X, which is the ray of the baſe; then from V, a little occult line cutting the ray X S in the point 5, which is the thickneſs of the wall. As to the depth, the ray Y S will give it by its interſecting with X T in the point 6; and Z 1 will give the breadth of the windows in the points 7, 8; from which points X, 5, 6, 7, 8, perpendiculars being raiſed, and the height 2 being ſet on the firſt of them X, and from the point 2 drawing lines to the points S T, the interſections with the perpendiculars will give the height of them all. From the height of the window, marked 3, 4, draw lines to T, and where theſe interſect the perpendiculars 7, 8, lines are to be drawn; and from the corners 9 to S, for the depth 10, draw lines to T, and from the point of interſection 11, draw a perpendicular. This may alſo ſerve for a paliſade as well as a wall.

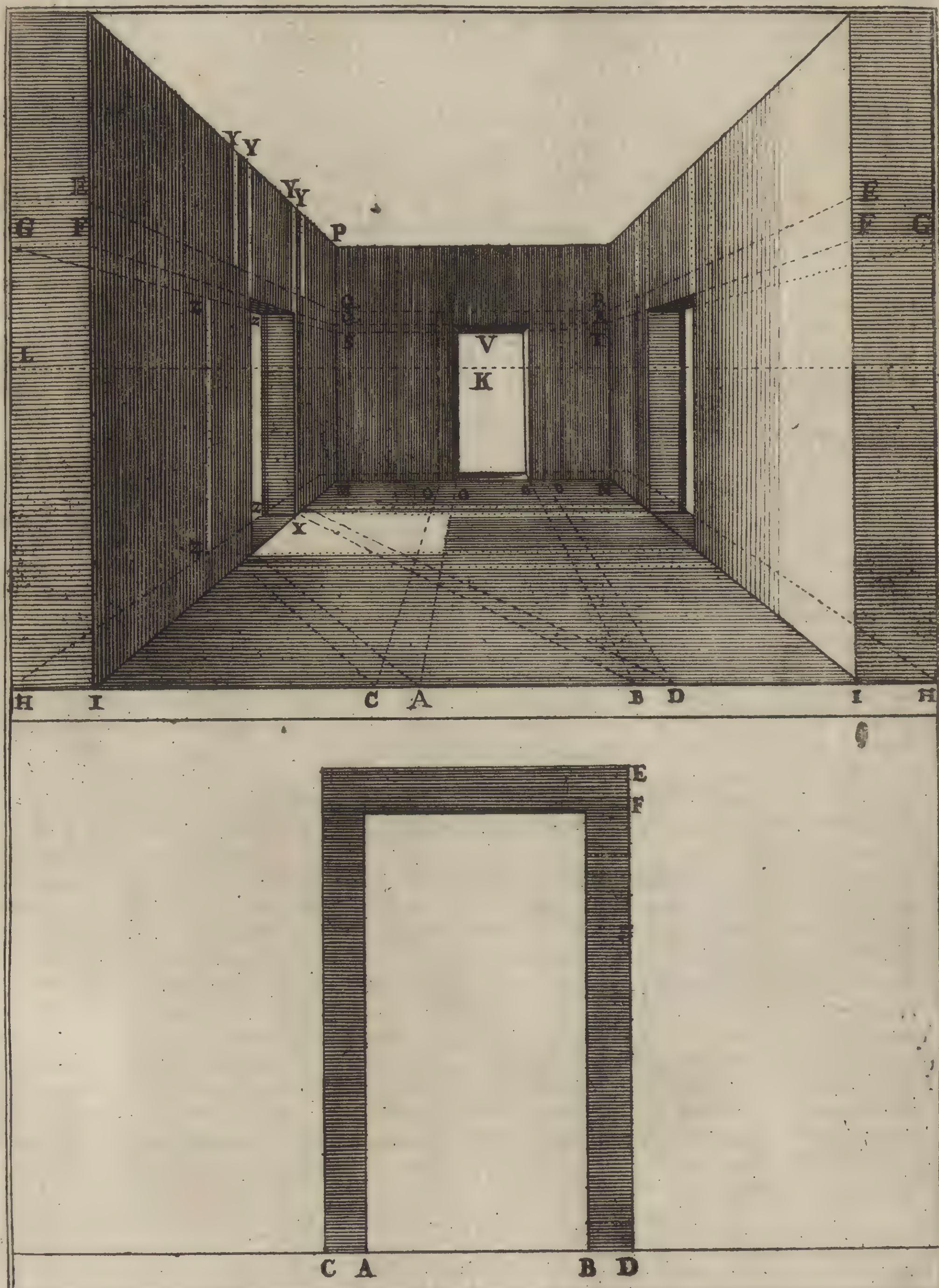

52
C
C
D
A
A
E F
H
K O L
P
N
E F
H
S
T
2
3
10
11
11
10
4
6
5
V X Z I Y
52

To place a Door in any part of a Wall at pleaſure.

A WALL being raiſed one, two, or three feet thick, on the points H I, and carried on of the ſame height, as already directed; in order to place a door in any part thereof, obſerve the following method. Suppoſe the door required is to be three feet wide, and all its dimenſions to correſpond with that of the lower figure. To place this door in the middle of the end wall, ſet the breadth on the baſe line, as here in A B, and on the ſide of A and B ſet the breadth of the frame, or band, D and C, and from A B C and D draw lines to the point of ſight K; and where they cut the parallel M N in the points O O, *&c.* erect perpendiculars of any heights at pleaſure. Thus is the width of the door procured. For its height, D F E is to be transferred from the door underneath to the corner of the wall I, and lines to be drawn from the points F E to K; and where they interſect the perpendicular M P in the point Q, draw Q R parallel to M N, which will give the height of the door, and the band or frame at top. Its thickneſs, or depth, will be the ſame with that of the wall, which is G F. And if from G you draw a line from the point of ſight K, it will cut the perpendicular M P in the point S, through which drawing S T parallel to Q R, you will have the thickneſs of the door V.

To make a door in a ſide-wall, the inſtructions given in page 17. are to be well remembered; importing, that all the meaſures are to be put on the baſe line; and, that lines being drawn from theſe meaſures to the point of diſtance, will give all the diminutions deſired. For an example, a door four feet broad is deſired in a chamber. Set off four equal diſtances from I to C, and draw lines from the dimenſions of the door C A and B D to the point of diſtance L; where the ray I M interſects thoſe lines, erect perpendiculars X Y, which will give the breadth of the door. For its height, draw lines from the point E and F to the point of ſight K, and the interſections with the perpendiculars will give the height. As to the thickneſs of the top and bottom, draw the thickneſs of the wall, G H and F I, to the point of ſight K; then drawing a little parallel to the terreſtrial line, through the lower corner of the door X, and another through the upper corner, you will have X Z, the thickneſs of the top and bottom, to be joined by a perpendicular, as you ſee in the figure.

If you would have a door on the other ſide, you have nothing to do but draw parallels to the baſe line from the point X to the ray I N, and then raiſe them as already directed. The reſt is the ſame as on the other ſide. The gate is not here repreſented in the middle; it is deſignedly placed elſewhere, to obviate the error of ſuch as without any other meaſures, draw two diagonals through their painting, though of ever ſo great a ſize, and make all their objects equally diſtant from the interſection of thoſe lines, that is, from the middle of the painting. So that, on their principle, a body ſhould always be mounted to ſhew their work in all its advantage; which is a palpable overſight. For though painting ſhould be forty feet high, and it ſhould be placed on the ground to be ſeen, the horizon ſhould never be above five feet high, but rather leſs than more; whereas in their way the horizon ſhould be twenty feet high.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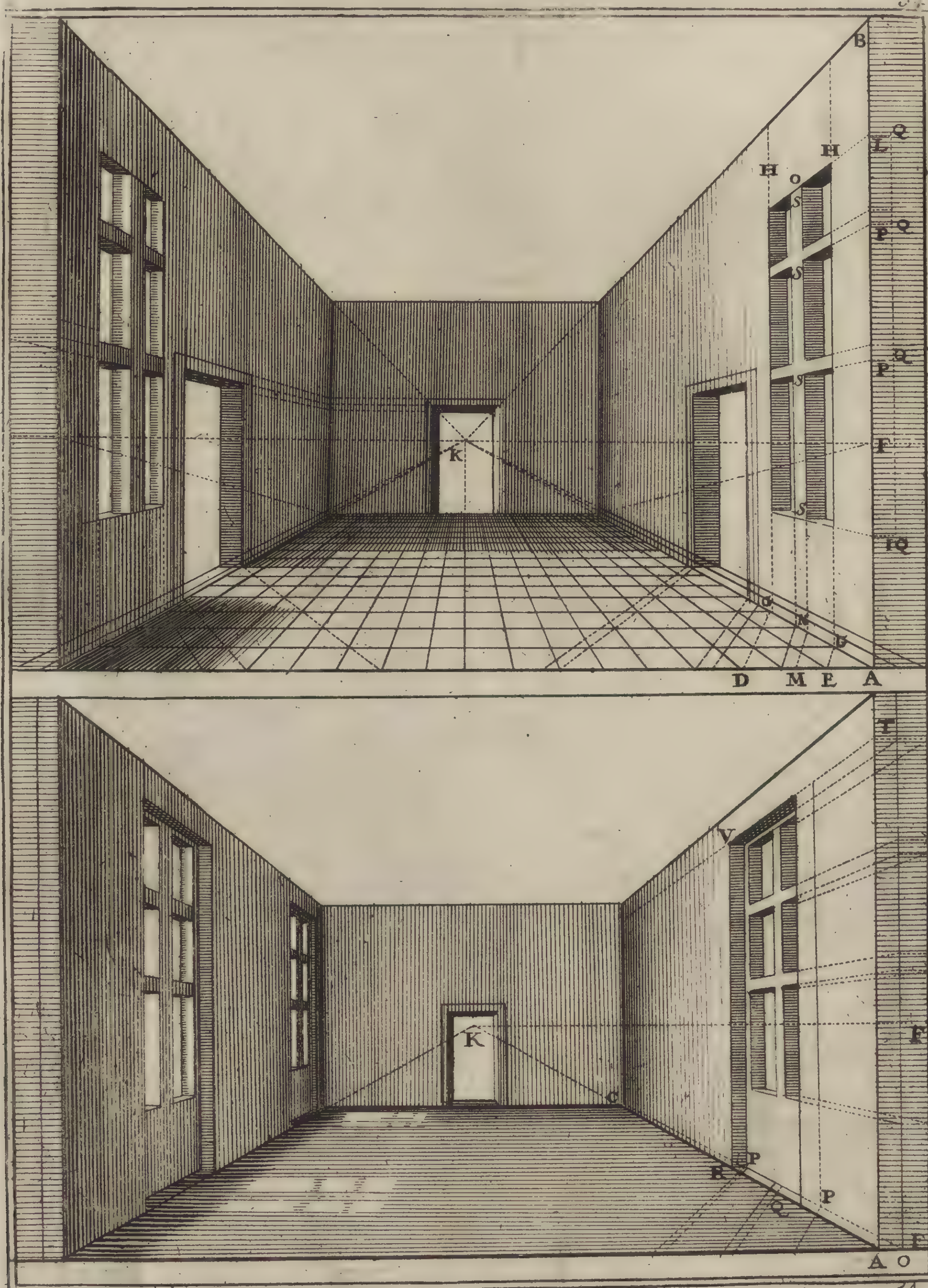
To draw WINDOWS *in Perſpective.*

THE method of deſcribing a window is perfectly the ſame with that of a door; therefore by learning to make a ſingle and double croſs, you are a maſter of windows. Suppoſe now it be required to make a window in the wall A B, of any breadth at pleaſure, lay down its breadth on the baſe line, as D E, and from the points D and E draw lines to the point of diſtance F, and from the interſections G G, of thoſe lines with A K, erect perpendiculars G H, G H giving the width of the window, which is here only two ſquares, or panes. As to the height, it is uſually raiſed as near the ceiling as may be, but the breaſt-part ſhould not be above three feet and an half; this meaſure therefore is to be ſet on the perpendicular A B, as from A to I, and drawing a line from I to K, where that line interſects the perpendiculars G H, will be the breaſt-part. After the like manner drawing a line from L, the top of the window, to the point of ſight K, its interſection with G H, will be the top of the window; by which means we ſhall have a long ſquare, or parallelogram, to which a croſs being added, will form a window. To make this croſs, the ſpace D E muſt be divided into two equal parts, each being about half a foot; then drawing this breadth M to the point of diſtance F, and from the interſections thereof with the ray A K, erect perpendiculars N O for the upright poſt, or ſtancher in the middle of the window. As to the croſs pieces, you may add as many as you pleaſe, only obſerving that their thickneſs muſt be equal to that of the upright piece; therefore taking the meaſure M, ſet it off upon the perpendicular A B, as is P, and drawing lines from P to K, the points wherein they interſect the perpendiculars G H, G H will give the croſs bars, and of conſequence the window is finiſhed. For its thickneſs, it is here only to be half that of the wall; to accommodate which, occult lines muſt be drawn from the point Q to K, and little parallels to the baſe being drawn from the corners of the window S, the point wherein they cut the line Q K will give the thickneſs required.

This window ranges even with the wall on the inſide, which is not very uſual, windows being now frequently made with embraſures, or niches entering into the wall a foot, or leſs.

The method is preciſely the ſame in both, only that inſtead of taking the interſections on the line A C K, they muſt here be taken in another line, re-entering into the wall as much as the window is made to re-enter, as appears from the lower figure, where the ray O K receives the meaſures laid on the baſe-line; and that all the reſt muſt be drawn to the point of diſtance F, as in the former caſe, taking the thickneſs of the window between the perpendicular O, and the other F, which is the laſt. Laſtly, when the window is finiſhed, on the ray O K, and from the breadth of the wall O F, raiſe the perpendicular A, and draw it to the point K; then from the lower corner of the window, in the points P P, draw a little parallel cutting A K in Q, which will give the thickneſs of the wall, covering the window a little, and ſhewing the thickneſs R P; then from the point R erecting the perpendicular R V, cutting the ray T K in E: which will be the thickneſs of the top of the window. From the meaſures here laid down, one may make as many as one pleaſes, ſtill obſerving the ſame order.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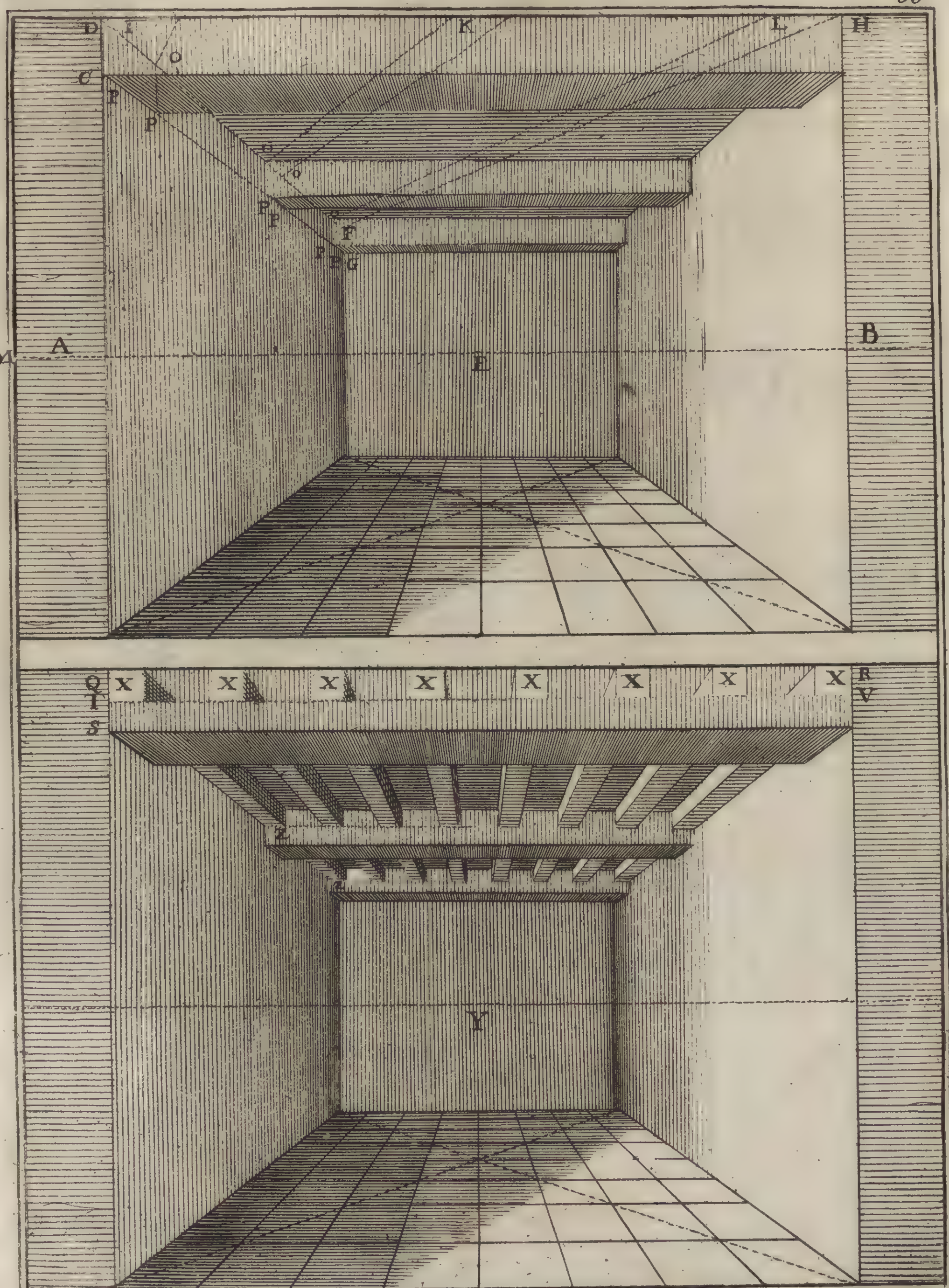
54

Of Cielings.

IN forming perſpective repreſentations, there are many inſtances in which we muſt obſerve a method, ſomewhat analogous to the order practiſed by maſons in raiſing a building from the ground. The pavement, or ground-work, is their foundation, whereon they raiſe walls, which they pierce in as many places as they pleaſe for doors and windows.

Suppoſe the walls A B raiſed, on which beams are to be laid, and over them joiſts or quarters. Having meaſured the ſquare of one of the joiſts (which we here ſuppoſe a foot) it is to be carried to the top of the wall, as C D, and from the points C and D occult lines to be drawn to the point of ſight E, which will give the rays C G D F. The ſame meaſure C D is likewiſe to be ſet on a parallel to the horizon D H, on which line the meaſures of all the intended joiſts are to be diſpoſed, as will be ſhewn preſently when I come to direct the drawing them. The meaſures of three joiſts are here placed at I, K, L; then drawing lines from all theſe meaſures to the point of diſtance M, and from the interſections with the line D F, in the points O, O, *&c.* letting fall perpendiculars, cutting the rays C G in the points P, P, *&c.* and laſtly, drawing parallels to the horizon through the points O and P, you will have the beams, or girders, orderly laid: as in the firſt figure.

Now, to lay the joiſts upon the beams, or, more properly, to mortaiſe them there, the line Q R, *Fig.* 2. is to ſerve as a baſe line whereon to lay the joiſts in ſuch number, and at ſuch diſtance from each other, as ſhall be judged expedient; the rule being uſually to be twice their thickneſs apart from each other. To mortaiſe them, take their thickneſs within that of the beam Q S, ſuch as Q T, and draw an occult line T V; then between Q R, and T V, range the joiſts X, X, *&c.* and from all their angles that are viſible, draw lines to the point of ſight Y. And that they may not exceed the half of the further beams, from the middle of the firſt, which is the point T, draw an occult line to the point of ſight Y, which will cut the other two beams in the middle of their depth, in the point Z; laſtly, from the point Z draw parallels to the horizon, which terminating the lines drawn from the angles of X X X, *&c.* to the point of ſight, will ſhew the joiſts mortaiſed in thoſe beams anſwerable to the others, in drawing lines from the joiſts to the point of ſight. If you do not care to take ſo much pains, ſet the joiſts Z on the line Q R, as they are underneath; then draw lines boldly from one beam to another, from all the angles of X, X, *&c.* to the point Y, and you will have what you require.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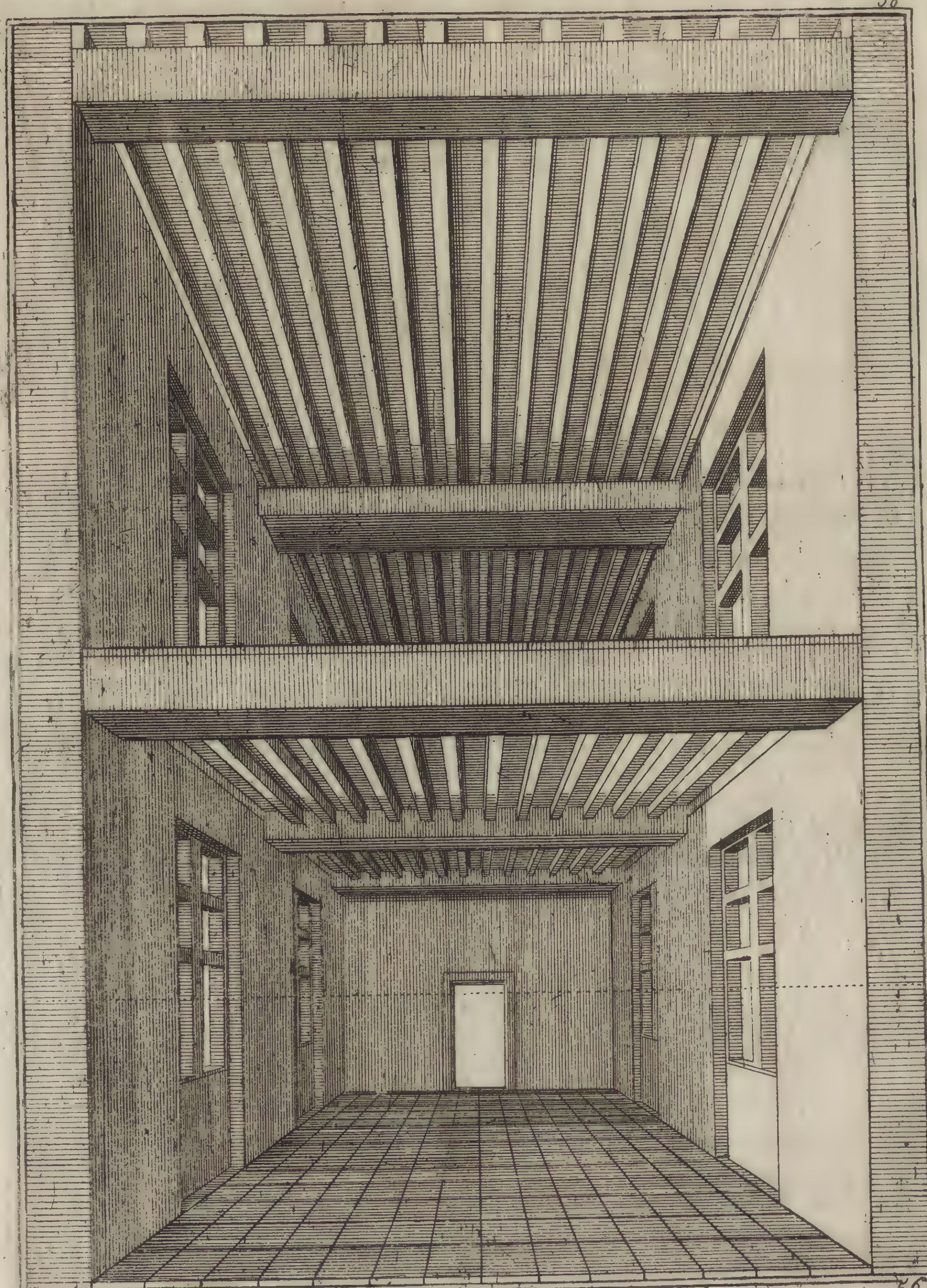
The CIELINGS *of two* Stories, *ſhewn in Perſpective.*

THIS FIGURE is only added to ſhew the effect of the method juſt now laid down; wherein it is obſervable, the number of ſtories does not render the practice at all the more difficult.

The joiſts are not mortaiſed in the beams of the upper ſtory, as they are in the lower.


56

Another Diſpoſition *of* Cielings *in Perſpective.*

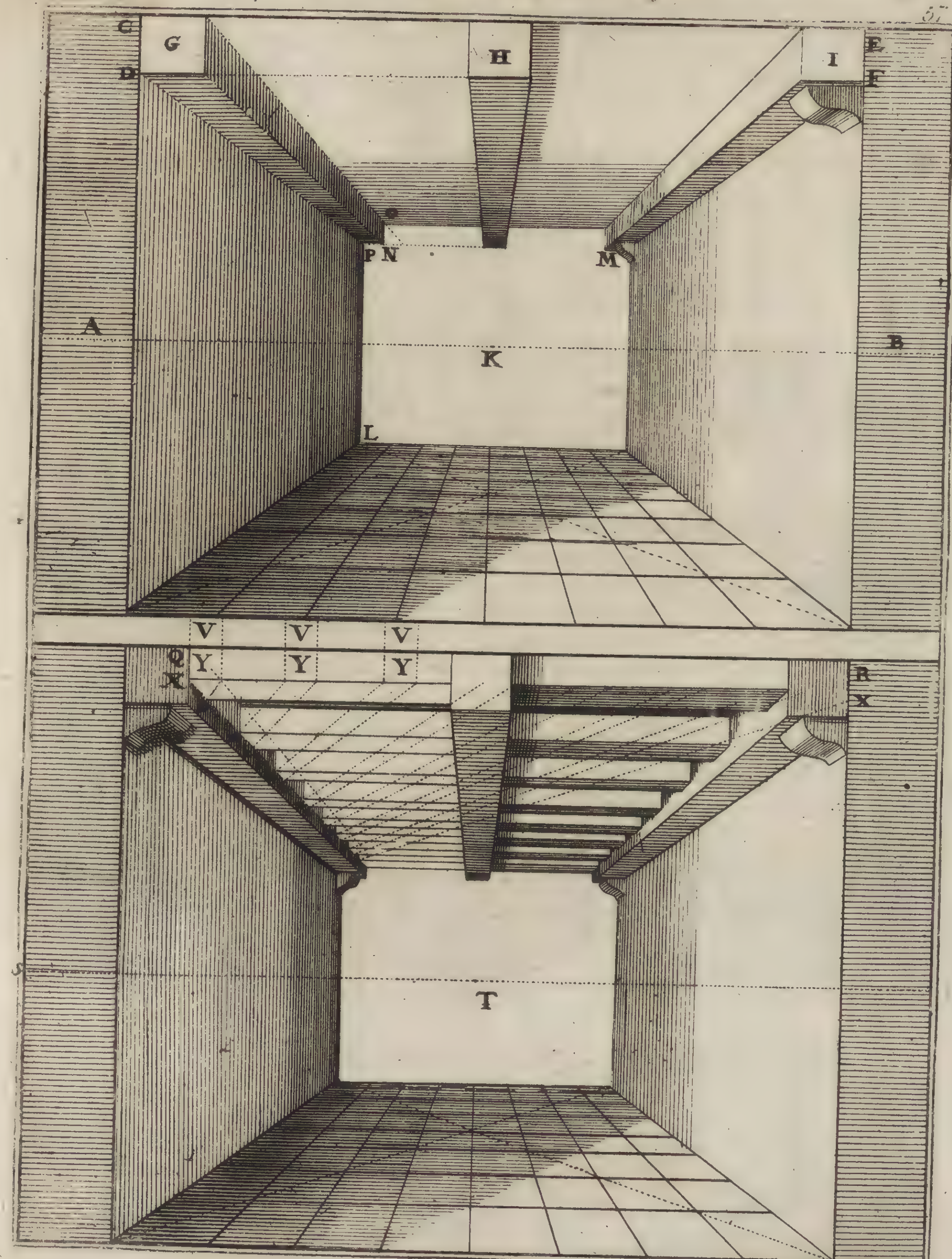
THIS method is performed in all reſpects like that juſt deſcribed, only that the diſpoſition of the members and pieces that compoſe the cieling is to be changed; that is, the beams are laid long-wiſe, tending towards the point of ſight, and the joiſts acroſs, which is the reverſe of the former.

Suppoſe the walls AB; on theſe, or on conſoles jutting out from them, ſet the thickneſs of the beam C D, and through the points C and D draw parallels to the horizon C E and D F, between which you may put any number of beams at pleaſure, in the manner that three are placed in this figure, namely G H and I, from all which, lines are to be drawn to the point of ſight K; then through the point P, wherein D P interſects the perpendicular L P, draw a line parallel to the horizon P M, this will be the bound of all the other rays, as G N, I M, *&c.* laſtly, from the point N erect a perpendicular N O: and ſo of the reſt. Thus much for the beams.

To lay the joiſts acroſs the beams, ſet their thickneſs on the line Q R, as V V V, *Fig.* 2. and from the extremes of V draw lines to the point of diſtance S; and through the points of interſection with the ray Q T draw parallels to the horizon, as far as the beam of the other ſide. If you would mortaiſe them in the beams, take the thickneſs of the rafters within the beam, as Q X; and from X draw a parallel to the baſe line, as far as the other ſide X X; and between the two lines Q R and X X ſet the diviſions V V, *&c.* which will form Y Y, *&c.* And from all the points Y drawing lines to the point of diſtance S, you will have the thickneſſes of the bottom and ſides given by the interſections with the ray X T in the points Z Z, *&c.* through which drawing parallels to the horizon, the cielings will be finiſhed; as in the ſecond figure.

Thus it is that ſimple timber cielings are put in perſpective. If, after theſe, or in lieu of theſe, you would have a handſome platform of painting, or enrichments of other kinds, the inſtructions given in page 35 for exhibiting the plan of a garden, are applicable to theſe purpoſes, for by making uſe of the line Q R for a baſe line, you will eaſily ſhew on the cieling the perſpective appearance of any deſign: and making uſe of the line Q R for a baſe line, you may do what you pleaſe therein.

As to floors and pavements, ſuch full inſtructions have been given for them in pages 30, 31, 32, 33, and 34, as to make the operation for ſhewing them very familiar and eaſy, and to open the mind for inventing what variety of them it pleaſes. Thus far we have had to do with the rooms, as hall, chamber, or the like, the ſeveral parts whereof are ſufficiently deſcribed: the moveables therein ſhall be ſhewn hereafter.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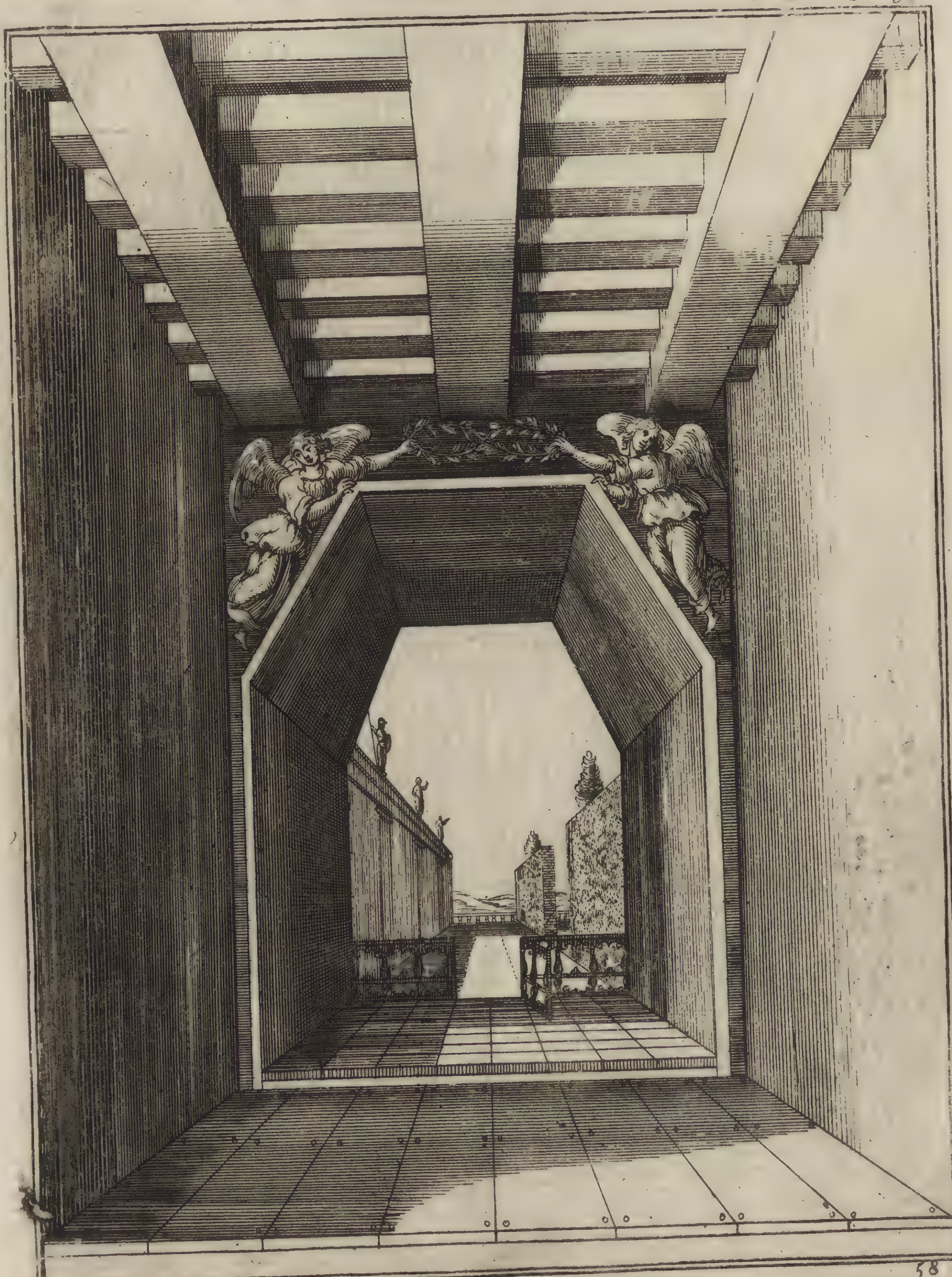
THIS figure ſhews the cieling juſt now deſcribed, diſtinct and clear of the lines wherewith the former was embaraſſed.

The conſtruction of the gate ſhall be ſhewn hereafter.



58

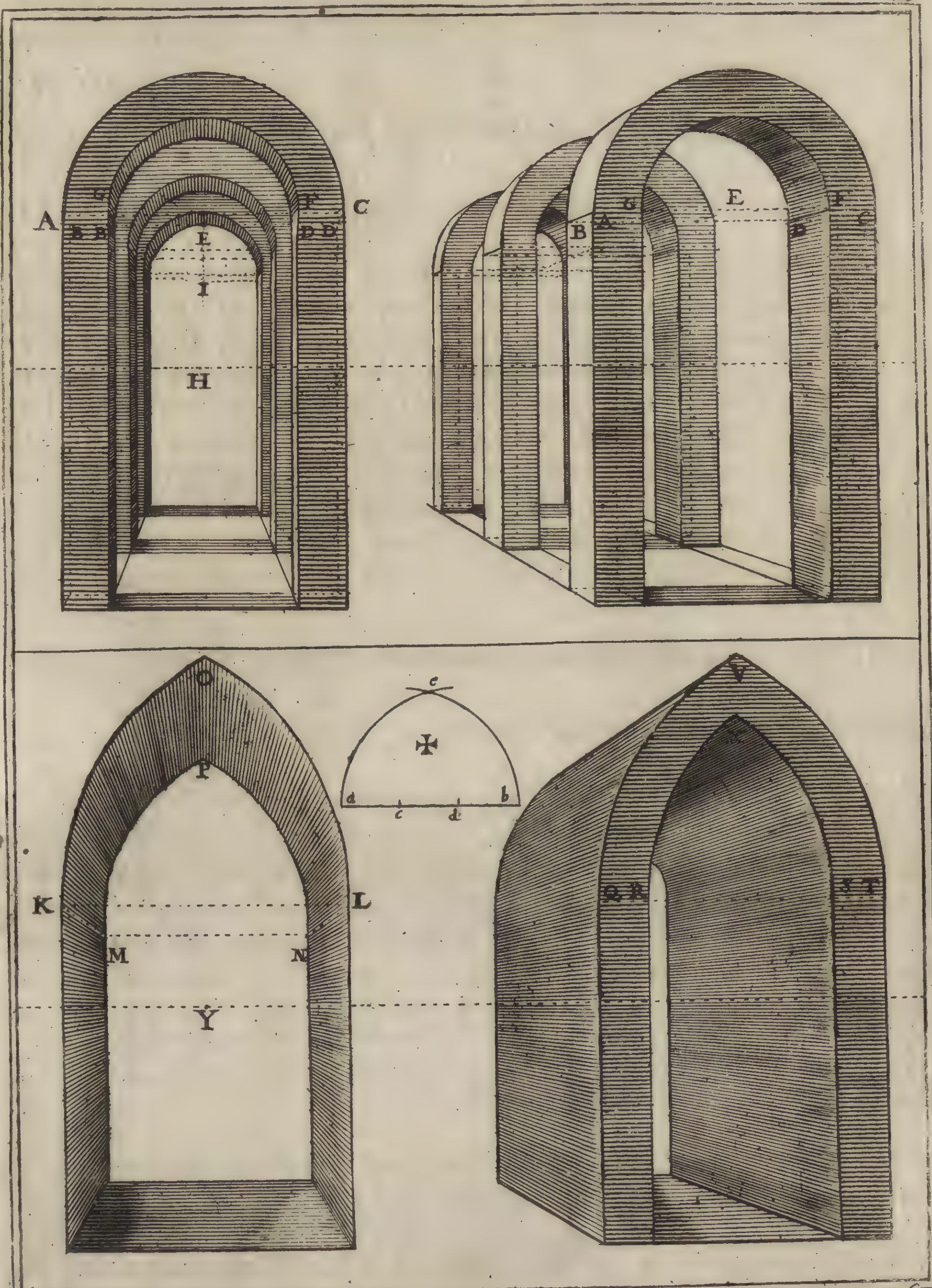
To describe Circular Gates *and* Arches *viewed directly in the front, or partly on the side.*

HAVING given sufficient instructions for halls, chambers, windows and *square* doors, or gates, we proceed to the practice of *round* ones.

Suppose then ABCDEF to be pilasters on a plan, in order to place arches thereon, divide the upper breadth G H into equal parts, in the point I, on which setting one leg of your compasses, with the other describe a semi-circle G H, for the first arch.

To make all the other arches of the same height and breadth, draw lines from the points G H to the point of sight K, and through the two points L, L, where those rays cut the perpendiculars C, D, draw parallels to G H. These parallels being divided into two, and semi-circles struck from them, as in the first, you will have the second and third arch. To find the middle of those parallels M, you have only to lay the ruler in the first center I, and draw a line to K, which will cut them all precisely in the middle M M, and give the points for the semi-circles to be drawn from. The arches viewed in front, and those by the side, are all performed the same way; as appears from the two first figures, and K is the point of sight both for the one and the other.

If it be required to make an edge, or band about them, of equal thickness, you are only to use one center as O, from which the thicknesses N P of the lower figures are formed. The rest is all performed as already directed, by drawing lines to the point of sight K. The last figures shew how all kinds of simple vaults, only consisting of a semi-circle, are to be formed. As to the enrichment thereof, we shall have occasion to speak hereafter.



60

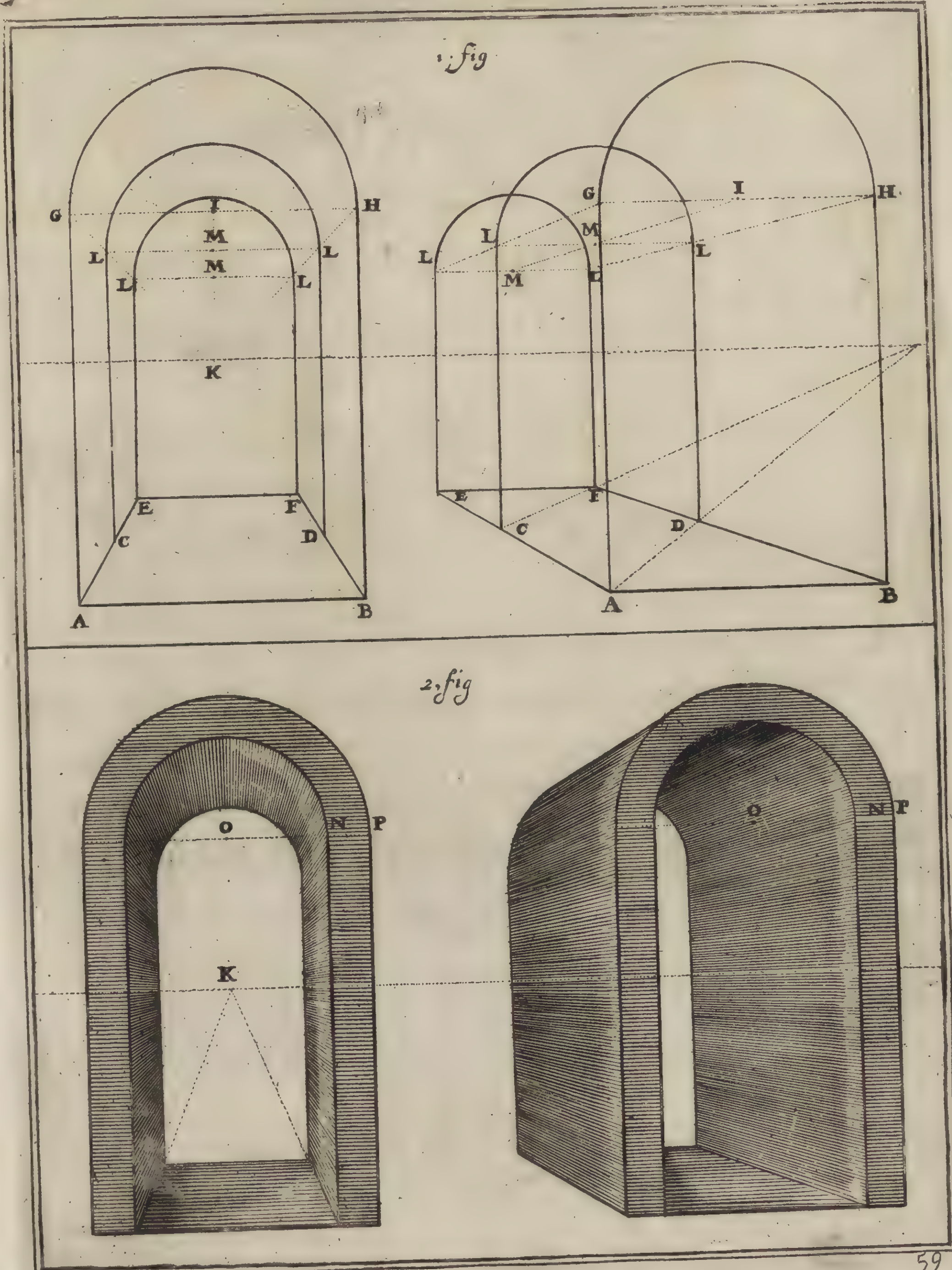
To describe Circular ARCHES *over* Pilasters *viewed as in the preceding plate.*

THE out-line of the last plate readily directs how to perform this operation, the method being the same in both. In the present case there are a few more lines, but not any thing more of difficulty. For, drawing parallels to the base line over the tops of the several pilasters, and dividing the first of them into equal parts, from the middle E as a center, describe the first semi-circle A C, without removing the compasses, from the same center describe the band or thicknesses A G F C; lastly, from the center E, drawing lines to the point of sight H, the ray E H will give the middle points of all the parallels for describing semi-circles over them all, from B D to the last, I. The method is the same for that in the side-view.

To describe the GOTHIC ARCH, *or* Arch *in the* third Point.

THE drawing of this is as easy as that of the circular arch. Having laid down the breadth K L, set one foot of your compasses in K, and directing the other to O, strike the arch L O; then removing your compasses to L, describe the arch K O, and you will have an arch *in the third point*, K O L. Do the same from M and N, and you will have the *second*, or *inner arch*, M P N. The second figure, *in the third point*, has a band or list all round it, which is described from the same centers: thus, for example, from the center R the arches S X and T V are swept; and from the point S the arches Q V and R X. All the rest is drawn to the point of sight Y.

Another *third point*, or *terzo acuto*, is represented in the figure +; the diameter or chord whereof, *a b*, being divided into three equal parts, and one foot of the compasses set in one of the divisions, as *c*, and with the other the aperture *c b* taken, the arch *b e* is struck therewith; then removing the compasses to *d*, the arch *d a e* is struck, which is an arch in the *third point*, as well as the former; and either of them may be used at discretion. Those in old *Gothic* churches come nearest the former kind.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Sequel *of the former* FIGURE.

WE here add an arbour of a garden, the performance whereof is in all reſpects the ſame as that of arches viewed in front.

Sequel *of the foregoing* RULES.

THE rules given in the two former pages, are applicable to a vaſt variety of deſigns. In this plate I ſhew one inſtance thereof in the perſpective repreſentation of an arbour, compoſed of five arches, of equal chords or diameters, and placed at equal diſtances behind each other. Theſe are exhibited by the method laid down in pages 59 and 60.

61

To describe, and put in Perspective, semicircular Arches *and* Doors.

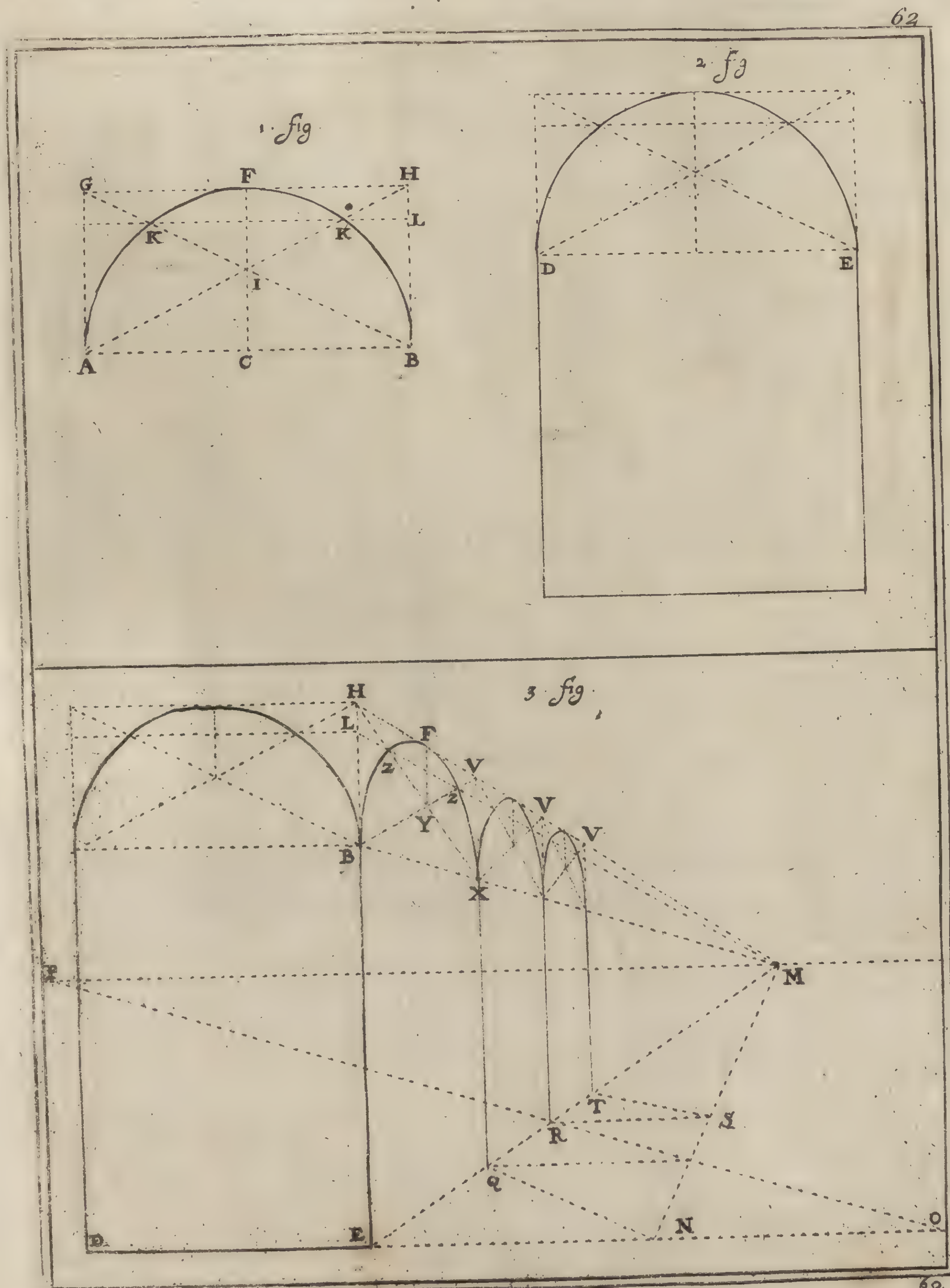
THE circle being somewhat difficult to put in perspective, requires a number of previous lines and points: to shew the method of procuring them is the design of *Fig.* 1. which ought to be well understood. To describe a semicircle upon a diameter A B, there needs no more than to set one foot of your compasses in the middle thereof, in the point C, and with the other to sweep a crooked line from A to B. And thus is the semi-circle to be upon the elevation D E, *Fig.* II. for a circular gate or arch.

Now to put it in perspective, it is to be divided into any number of parts, and the more the better; as already observed in page 28. and as I shall hereafter have occasion to shew, when giving directions for the exhibiting of cross vaults. The present semicircle I shall only divide into four, and that by circumscribing it with a parallelogram, or long square, and drawing two diagona's intersecting each other in I, and the semicircle in K K, and laying a ruler over C I, bisecting the arch in F; lastly draw the line K K, cutting the parallelogram in L, which line L K is to be transferred to *Fig.* III. to put it in perspective.

First then draw a line from the angle E to the point of sight M, set off the measures of the diameter of arch D E on the base line as E N, N O, and from the point N draw a line to the point of distance P; which cutting the ray E M in the point Q, E Q will be the width of the front arch D E in perspective. Then drawing a line from O to the point P, where it cuts the ray E M, in the point R, will be the width of the second arch. As there is no more room on the base line to take the third arch, a line must be drawn from N to the point of sight M; and through the point R a parallel to the base lines R S. Now as R S is under the same angle with E N, it is the same breadth in its proper diminution, as has been already proved in the beginning of the book; therefore drawing a line from S to the point of distance P, it will cut the ray E M in the point T, which gives the third arch.

Proceed then to raise perpendiculars V V, *&c.* from the three points Q R T, which intersecting the ray H M, will give the highest of the arches; then from the ray B M, which gives the bottom of the semi-circle, draw diagonals B V, H X, which intersecting each other, give the place of the perpendicular Y F, that divides the arch into two; and drawing the ray L M, it will cut the diagonals in two, and the arch in four; lastly, connecting the points B Z, F Z X, with curve lines, you will have the first arch: and this method will give you infinite others. The same serves not only for arches and doors, but also for vaults, bridges, and other things that require the semi-circle; for which reason it is that we decline speaking any thing farther of the two latter.

The same method may likewise serve for church windows, only one or two upright posts are to be added to fasten the glass to.



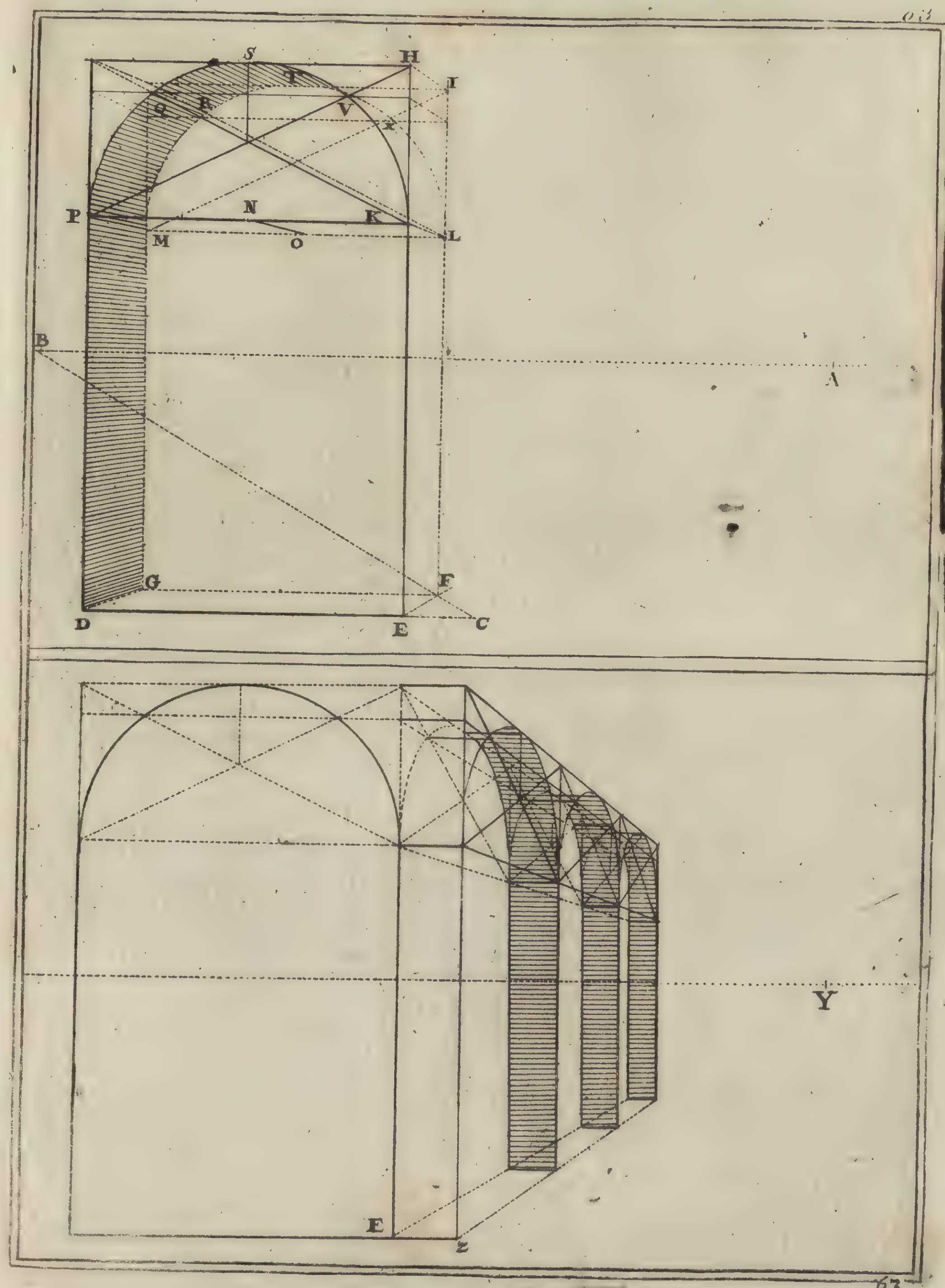
X

To describe, and put in perspective, double ARCHES *and* GATES, *that is, such as shew their* thicknesses.

THE former page only shews the formation of the out-line: I therefore now proceed to the method of compleating the same and exhibiting the breadths and thicknesses of the arches, and their supporters, by only connecting the interfections of each by right lines: for example,

Having described the first line D E, and drawn lines from D and E to the point of sight A, set the breadth or thickness on the base line E C. From the point C draw a line to the point of distance B, and where it interfects the ray E A in the point F, draw the line G F parallel to the base line, which will cut the rays D A and E A in the points F G, and give the thickness required. Then from F G erect perpendiculars, and from H draw a line to the point of sight A, the interfection whereof with the perpendicular F I gives the height of that side. To find the chord or line of the center of the inner semi-circle, draw a line from K, the extreme of the diameter of the semi-circle seen in front, to the point of sight A, which gives the point L, a parallel drawn through which will have the center of the hinder semi circle upon it, as N is the center of that before. This line M L is to be divided into two equal parts, by drawing a line from N to A, through O. Then setting one leg of your compasses in O, with the other describe a semi-circle M L, to be divided like that in the preceding figure. Lastly, draw right lines from the divisions of the one to the other, that is, from the fore semi-circle to the hind one, to connect the two into one; as in the figure, M is joined to P Q, to R S, to T V, to X L, to K.

For circular arches, *&c.* viewed in front, as D E F G, there is no need of so many divisions, it being sufficient to find the line M L, in order for the describing of the semi-circle, which refers to the first N P Q; but I have made them designedly to avoid confounding the letters with the lines of the lower figure, where the arches are viewed obliquely, tending all towards the point of sight Y. Such arches would give their thicknesses by repeating the operation already laid down for *Fig.* I. twice over, and joining the divisions of the one to the other, as already observed, and as is expressed in the present figure, to which having given the thickness E Z, I have drawn the line E in dots, and Z a full line, in order to avoid confusion, and to intimate, that whatever is done with dots, is not intended to be seen when the draught is finished.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63

Another METHOD *of describing* Circular Arches.

THE arches in front, which I have hitherto defcribed, are all performed to the laft exactnefs; but the procefs is a little long and tedious: I fhall now add another, equally juft, but much more expeditious.

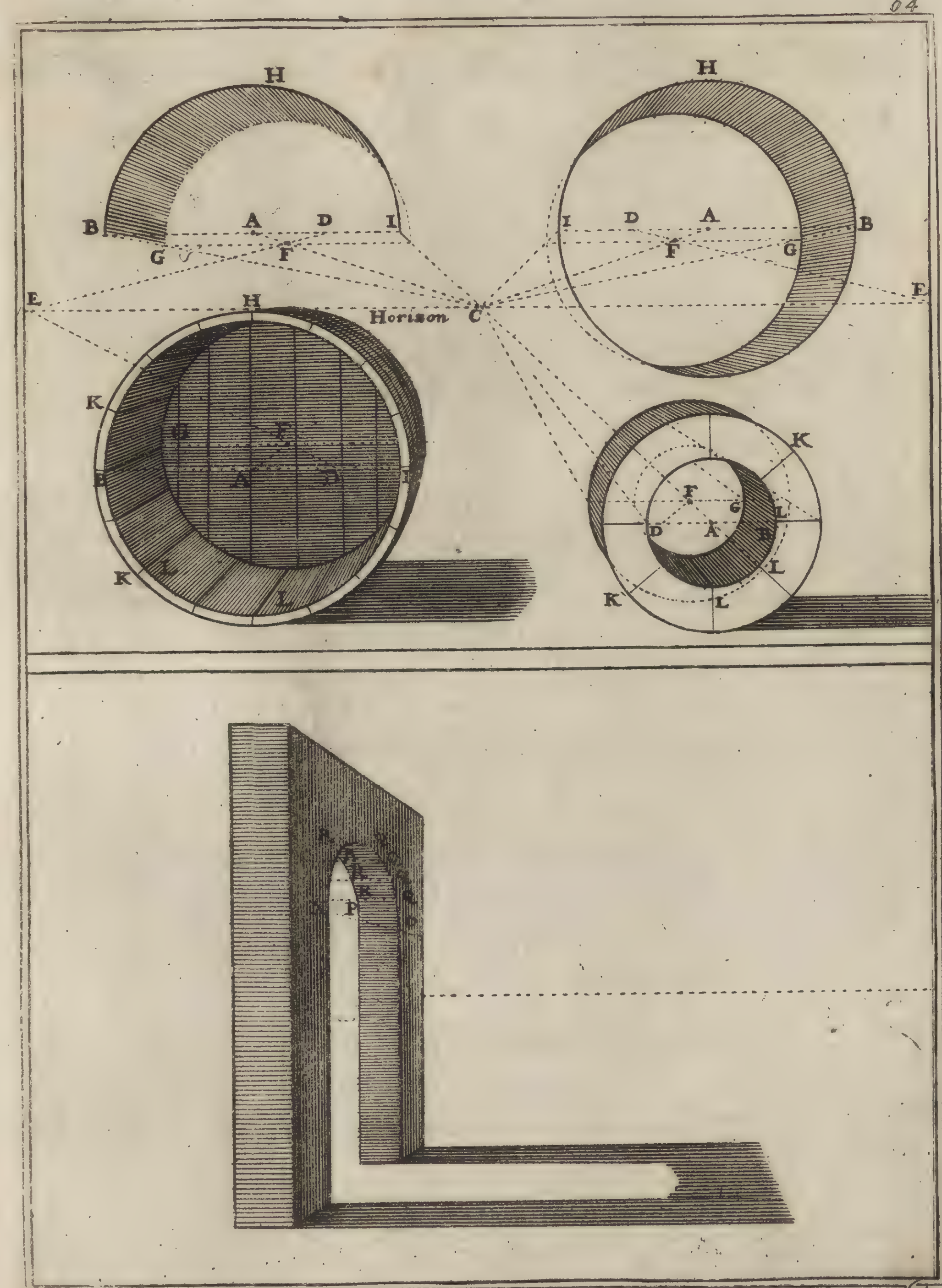
Having defcribed a femi-circle, or a whole circle, B H I, from the center A, from the fame center and the extreme of the diameter B, draw lines to the point of fight C; then fetting the breadth, or thicknefs required, on the line B I, as here D A, from the point D draw a line to the point of diftance E, and through F, the point where D E and A C interfect, draw a line parallel to the bafe, till it cut the ray B C in the point G; this done, fetting one leg of your compaffes in F, and in the other taking the diftance G, defcribe a femi-circle, or circle, which will be the thicknefs of the arch, or fweep: as is feen in the four different figures, which are all performed by this eafy procefs. All the lines K K, *&c.* in the third and fourth figures are to be drawn to the center A, and the others, L, to the point of fight C. The fame method may ferve for circular windows built of ftone, in which cafe the lines will reprefent the joints; as alfo for tons, vats, *&c.*

An expeditious method for ARCHES *viewed* obliquely *in perfpective.*

THE following method may ferve when a perfon is ftraitned, and does not defire to be fo very exact; as alfo to avoid a multiplicity of lines, which in the preceding method is indifpenfible.

Having formed the firft arch N O as already directed, acrofs it draw little parallels to the bafe in any number at pleafure, as here Q Q, *&c.* then with your compaffes take the breadth of the fpring of the arch, as P O, and fet it off on the little parallels Q, by this means you will have the points R R; through which a curve line being drawn, will form the thicknefs of the arch.

It is certain, that, according to the rules of perfpective, objects appear the larger as they are the nearer to us; of confequence, therefore, the line O P fhould be the fmalleft: but the difference is here fo very fmall, that it is not worth the minding. Befide, I do not give this as a conftant rule, but only for an expeditious fhift in cafes of neceffity.


H
B
A
D
I
G
F
E
Horizon
C
K
L
P

To exhibit ELLIPTICAL *or* FLAT ARCHES.

THE method of putting theſe arches in perſpective, is the ſame with that of the ſemi-circular, as appears from the figure A B. All the difficulty is in finding the out-line, which is done two ways.

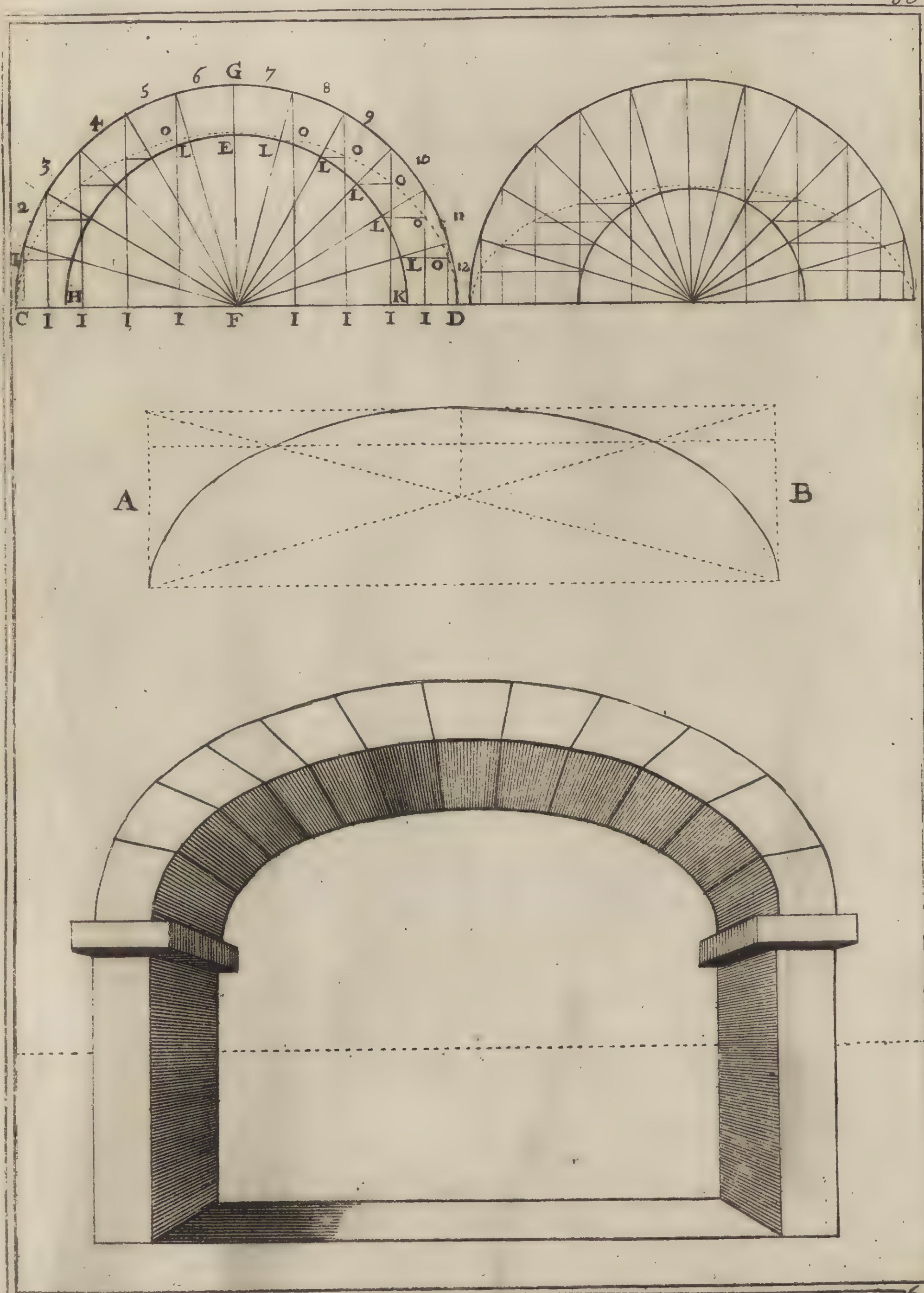
The firſt by two centers and a ſtring, the method already mentioned page 4, for deſcribing an oval; theſe flat arches being, in effect, ſemi-ovals.

The ſecond method is thus: Suppoſe the line C D given you to raiſe a flat arch upon of the height E F, from the center F deſcribe a ſemi-circle C G D, and divide it into any number of equal parts at pleaſure, as is here done into twelve; and from all theſe diviſions draw lines to the center F; then again, from all theſe diviſions draw perpendiculars to the diameter or chord C D, as are here the lines O I; this done, deſcribe a ſemi-circle of the given height of the arch, as here H E K; and through the interſections made by this leſſer circle on the diviſion-lines of the greater, draw little parallels to meet the perpendiculars which fall from the ſame diviſions, for inſtance L O, L O, &c. and the ſeveral points O connected together, as is here done, will give you the arch required.

The other figure makes the arch ſtill flatter, and by the ſame rules it may be made of any lowneſs at pleaſure.

The figure underneath ſhews one of theſe arches in perſpective, ſuch as it ſhould appear, when finiſhed, in a front view. I ſay nothing of the method, as having already intimated it to be the ſame with that for the ſemi-circle.

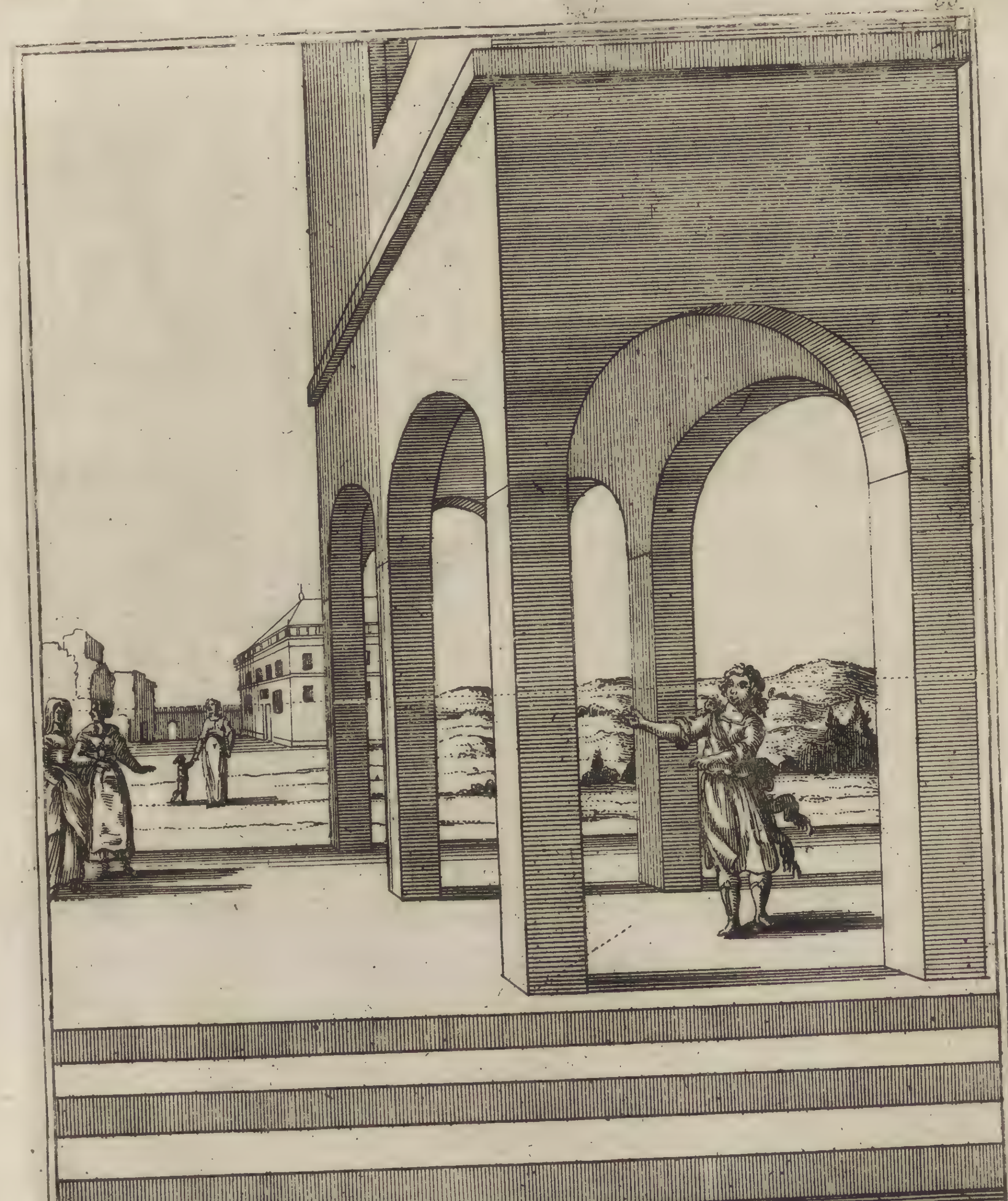
65



65

IN the figure here repreſented, you have an inſtance of the fine effect of ARCHES when they are well centered, that is, when their juſt rotundity is given them, in their different perſpective ſituations.

As for the ſteps and figures, I ſhall have occaſion to treat very particularly of them hereafter.


66

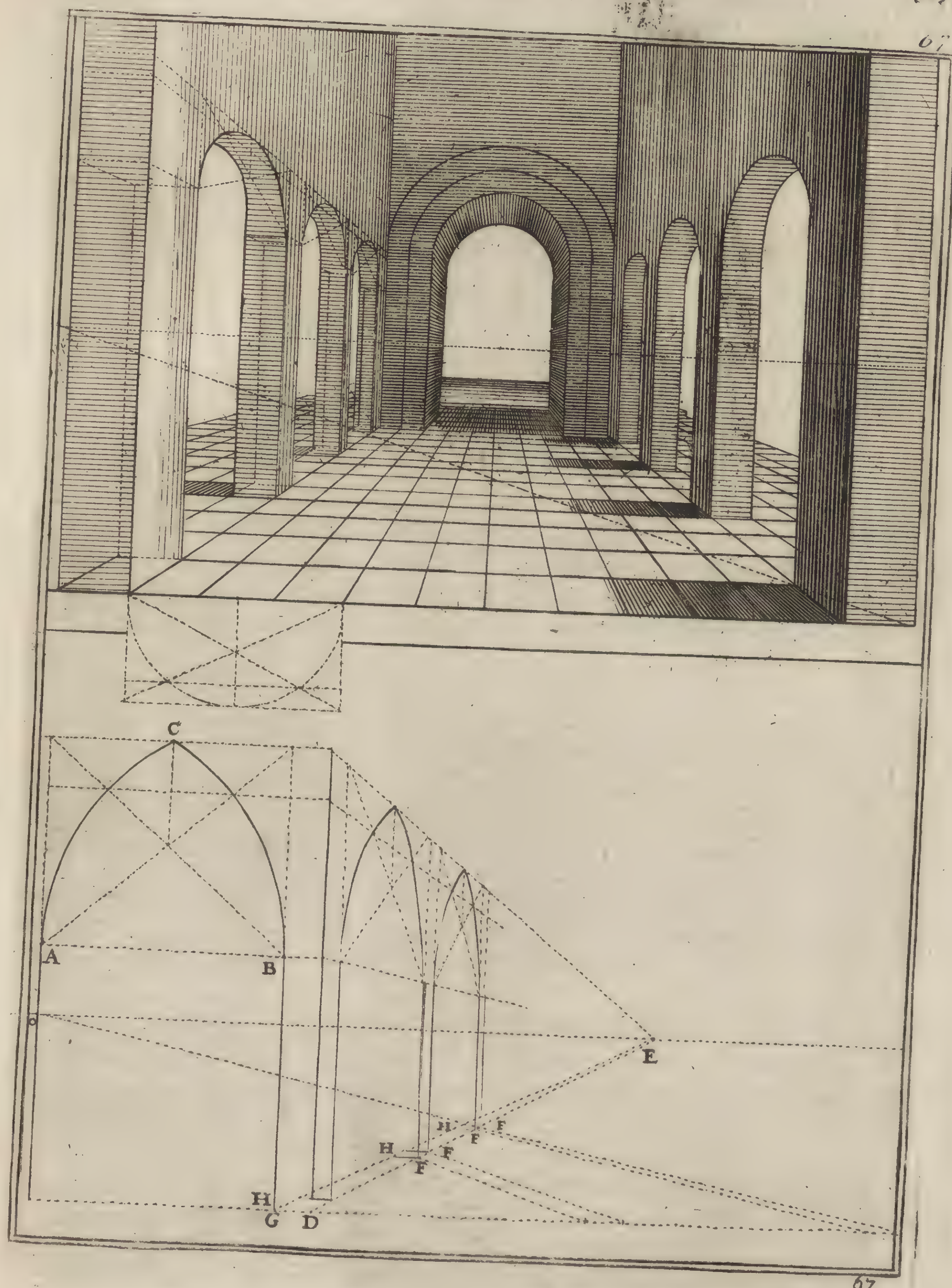
To raiſe Arches *upon* Pilaſters *or* Columns.

IT looks as if there were no pilaſters formed in the laſt figure, for which reaſon I determined to add this, which may ſhew, that the method is preciſely the ſame, and that all required farther, is to leave room for the breadth, *&c.* of the pilaſter between every two arches, which is done by means of the plan, or baſe line; as already directed for *circular arches.*

Gothic Arches.

Gothic Arches and Vaults, called alſo arches in the *third point*, ſee page 60, are performed in the ſame manner as the ſemi-circular; ſo that having done one, you will do the other with eaſe. The figure ſhews the reſt. As to the out-line, I have already ſhewn that nothing is more eaſy. The breadth A B being given to form an arch of, open your compaſſes to the breadth, and ſetting one leg in A, with the other deſcribe the arch B C; then removing them to B, deſcribe another arch A C; and the point wherein the two interſect, will be the point or apex of the arch C.

As the other arches ſeen on the ſide view are performed after the ſame manner as the ſemi-circular, page 62, I ſhall not repeat it. All the buſineſs is, that here are pilaſters between each two, that are not in the other. This may ſerve to confirm and exemplify what I have already ſaid, that all that is to be done is to draw lines from theſe diviſions on the baſe to the point of diſtance O, which will cut the ray D E in the points F F, *&c.* on which points perpendiculars are to be raiſed; then ſetting off the thickneſſes G, and drawing the ray G E for the breadth of the pilaſters H, from the ſame point H erect perpendiculars, to be connected to the other by the right lines, *&c.* as in the ſemi-circle.

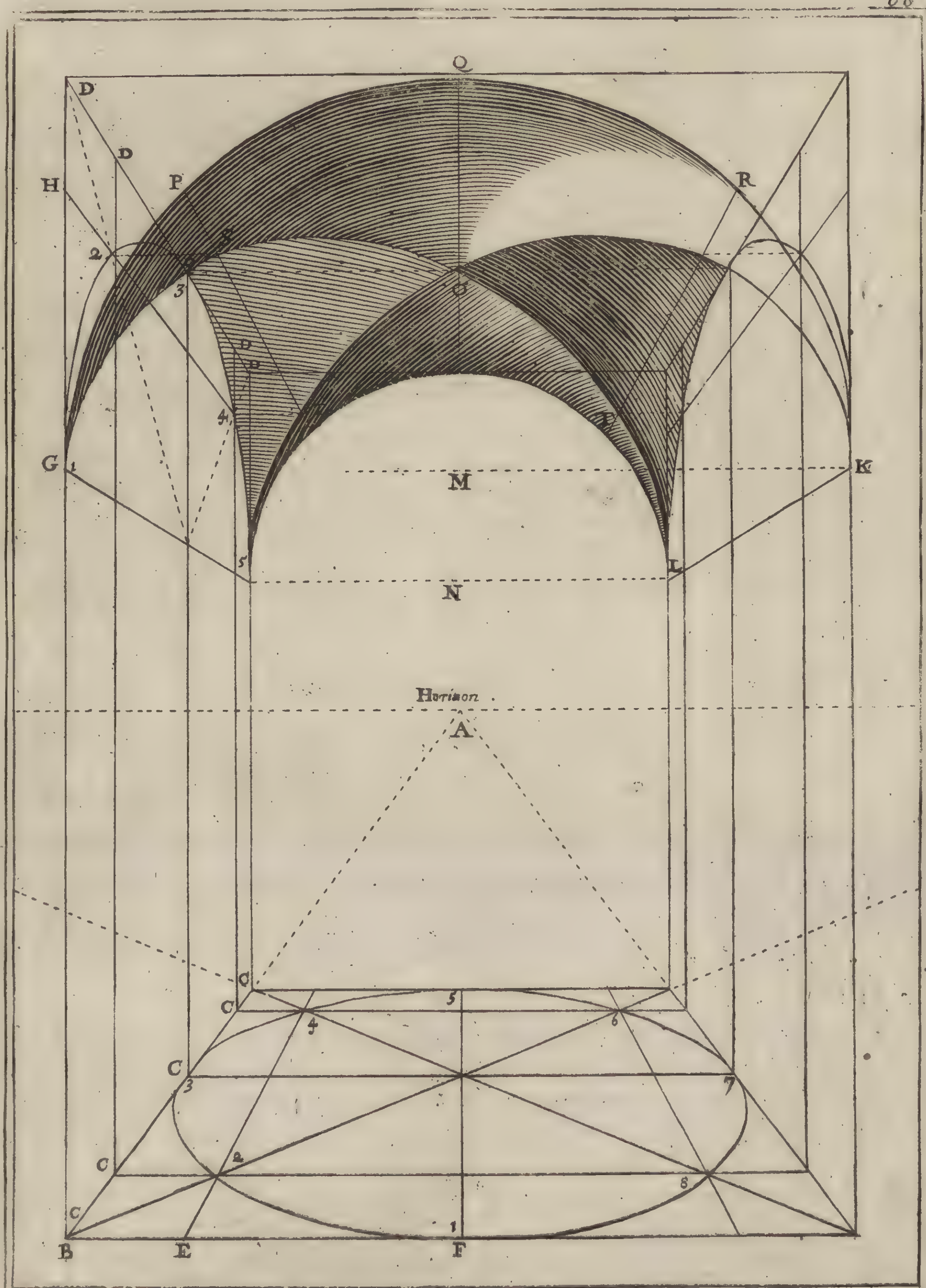

67
C
A
B
E
H
F
H
F
H
F
H
G
D
67

To find Cross Vaults *in perſpective.*

THE reader muſt remember, or have recourſe to, what I have ſaid in page 28. where, ſpeaking of putting a circle into perſpective, I divided it, for the greater exactneſs, into ſixteen parts; but as in ſuch a diviſion there neceſſarily occur a great number of lines, I have here choſe to take up with a diviſion of eight parts, which if it be the leſs exact, it will be the leſs confuſed. The other diviſion I ſhall reſume in the following page.

Having then formed a plan of a circle divided into eight parts, 1, 2, 3, 4, 5, 6, 7, 8, parallels to the baſe line are to be drawn through the ſeveral diviſions thereof, as far as the ray B A, which will give the points C C, *&c.* on which erecting perpendiculars C D, C D, *&c.* the firſt of them, B D, being the line of elevation, all the meaſures of the ſemi-circle B E F muſt be ſet thereon, by which means you will have the points D H G; from which rays are to be drawn to the point A, and in the interſections of the perpendiculars C D, you will have the ſame diviſions as in the firſt, ſecond, third, fourth, and fifth Plans. For a ſemi-circle, draw curve lines as in the arch of the firſt ſide, the diviſions whereof are to be transferred to the other, in order to have two collateral arches from the center M; the other in the bottom 5 L, from the center N. And thus you have the four arches ordinarily found in croſs-vaults. All that remains is, to make the croſs, or crooked diagonals, reſting on the corners G 5, K L, and paſſing through K or the groin O.

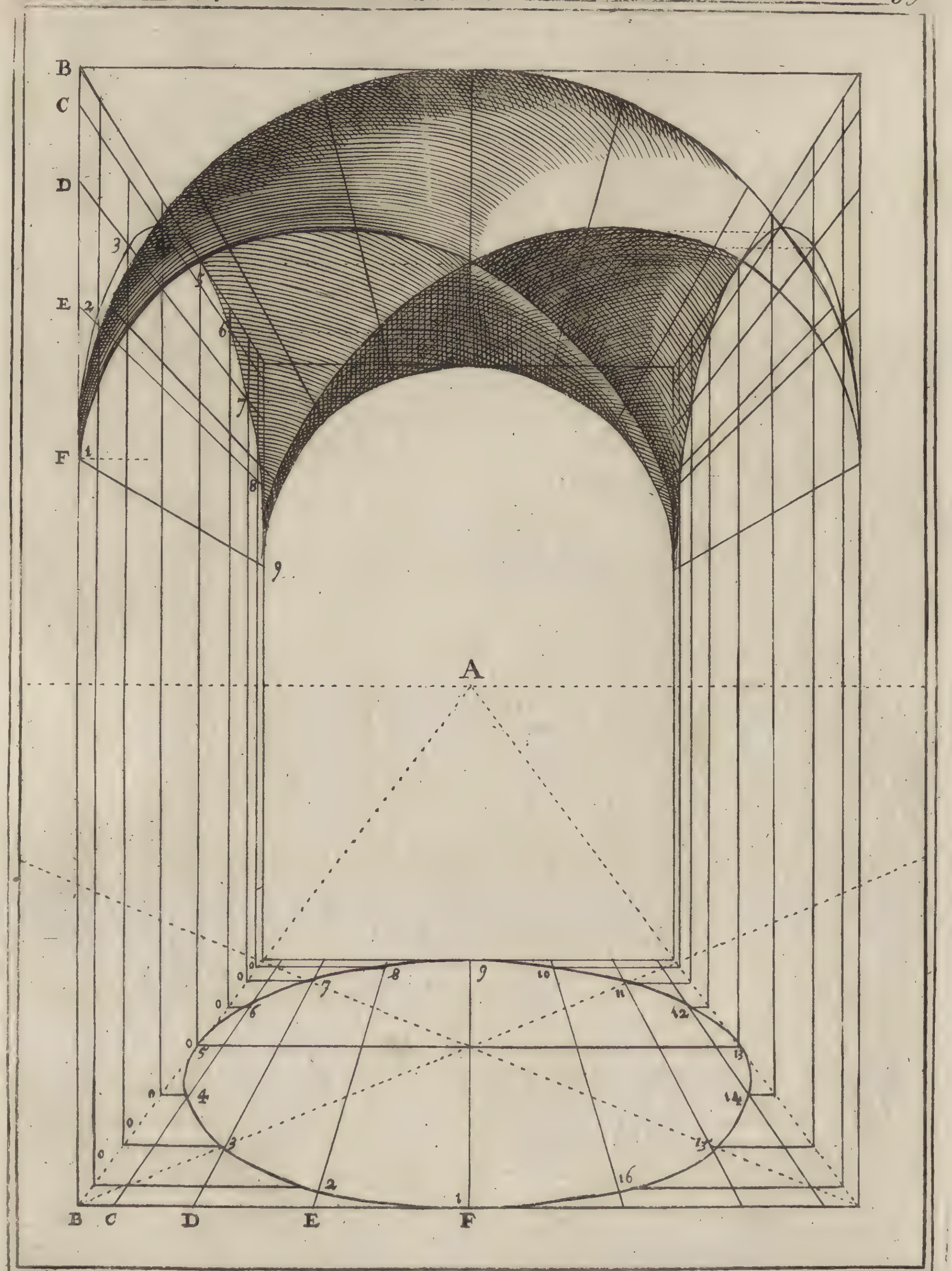
Now as the circle is divided into eight parts, the arches, which are but halves of circles, are only to contain four parts; the ſemi-circle G K, therefore, is to be divided into four parts, in the points G P Q R K, which are to be drawn to the point of ſight A, as far as the bottom of the circle 5 L. Now what follows is the great ſecret of the croſs, namely that parallels to the horizon are to be drawn from all the interſections of the circle on the ſide 1, 2, 3, 4, 5, in ſuch ſort, as that G, which is the firſt diviſion of the circle, touch the interſection 1 in a point; that from 2 a parallel be drawn to the ſecond diviſion P, and the point S to be marked; that from 3 another parallel be drawn to the third diviſion which will give O, the place of the key or groin; and from 4, another to the point T; laſtly, connecting G S O T L with curve lines, you will have a diagonal; and doing as much for the other ſide, you will have the entire croſs, and the vault compleat.


Q
D
D
H
P
R
2
3
D
4
G
M
K
5
L
N
Horizon
A
C
C
5
4
6
C
3
7
C
2
8
C
1
B
E
F

To draw the ſame VAULT *more accurately.*

A MAN who has a good notion of the former method, will find no great difficulty in managing this; all that is required being to double the lines, and take care of the interſections, which are here more numerous, by reaſon the circle is divided into more parts.

How to form the plan is taught in page 28. Having produced the circle, and obtained the diviſions on its periphery, from theſe diviſions draw parallels to the ray B A, and their interſections will give the points O, O, O, *&c.* from which perpendiculars are to be raiſed. The reſt of the proceſs is the ſame with the method laid down in the preceeding page, over which this has the advantage of exactneſs, and enabling you to draw the vault more eaſily, becauſe the diviſions are cloſer to each other.


B
C
D
E
F
A
B C D E F
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

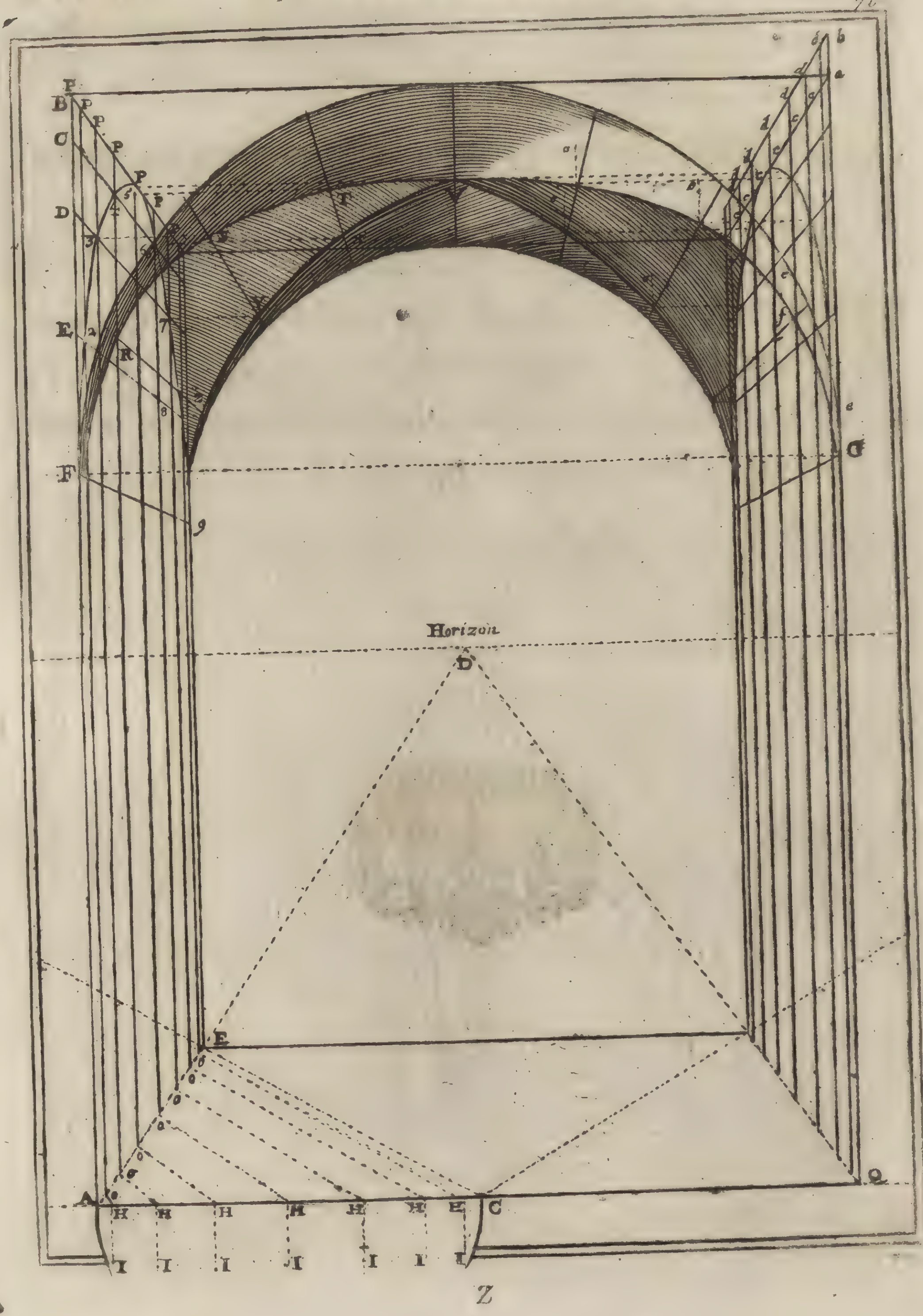
To form narrow VAULTS.

THERE are two proceſſes in this figure; the one for contracting or ſtraitning ſide-vaults; the other for giving the thickneſs to the croſs. I ſhall begin with the firſt.

The two methods for vaults already laid down, ſuppoſe them perfectly ſquare, that is, that their breadth and depth, or diſtance, is equal; both in thoſe repreſented in front, and thoſe in ſide-views. But a perſon only inſtructed in theſe, would find himſelf ſtrangely at a loſs were he put to conſtruct a church, where the ſide-arches are uſually much narrower than thoſe in the front or middle.

I proceed, therefore, to offer you an expedient whereby you will be enabled to make the ſide arches of what dimenſions you pleaſe, and that by means of the baſe line A Q. Suppoſe then the front arch A Q forty feet broad, and the ſide-arches limited to fifteen or twenty, you are now, according to the inſtructions in page 17. to ſet this meaſure on the baſe line, and to draw a line from the ſame to the point of diſtance, by which you will have the depth of the ſame figure in A E. Thus, in the preſent example, A C being ſuppoſed twenty feet, a line drawn from C to the point of diſtance, (which here is ſuppoſed beyond the limits of the paper) cuts the depth twenty feet in the point E; then returning to the baſe line, an arch or ſemi-circle is to be ſtruck on the line A C, and divided into as many parts as the larger arch F G has diviſions, namely, eight; and from the ſeveral diviſions perpendiculars H H to be let fall on its diameter A C, and from the points H, lines to be drawn to the point of diſtance, interſecting the ray A E in O, O, *&c.* Perpendiculars O P, O P, *&c.* are to be raiſed; then the plan of the ſemi-circle F G is to be made in ſome ſeparate place, and the diviſions thereof transferred from F to B. And ſince the plan of the preceding figure, ſee plate 69, is equal to F G, take the diviſions of half of it, B C D E F, and transfer them upon the perpendicular A F; and from the points E F D C B draw lines to the point of ſight D, and through the interſections which theſe rays B C D E F make with the perpendiculars O P, draw curve lines, which will form the ſide-arch. Then drawing parallels through the interſections 1, 2, 3, 4, 5, 6, 7, 8, 9, to the diviſions of the arch F G, you will have points F R S T V X Y Z, to form the croſs after the manner already mentioned.

For the thickneſs of the nerves, or branches, a little line of elevation muſt be made, *a b*, which I have here added at the top of the perpendicular raiſed from Q. This line A B, being drawn to the point of ſight D, cuts all the other perpendiculars in the point *c d*, and this gives the proportionate heights to each perpendicular raiſed from the interſections of the croſs, that is, from the interſections made to find the out-line of the croſs: the firſt elevation *a b*, for inſtance, gives the firſt perpendicular G *e*; the ſecond elevation *c d* gives the ſecond perpendicular F *e*; and ſo of all the reſt in their order, which all give points *e e*; and which being connected by a crooked line, give the thickneſs of the nerves or reins of the vault: as is ſeen in half the adjoining figure.


Horizon
D
E
A
H H H H H H E C
I I I I I I I
Q
F
G
B
C
D
E
Z

A VAULT *on the Principles of the preceding Rules.*

THE ſeveral rules already dilivered, ſuffice for the conſtructing the various arches of a complete VAULT, as that hereto annexed. The rules for the columns, or impoſts, I ſhall have occaſion to ſhew hereafter.

72

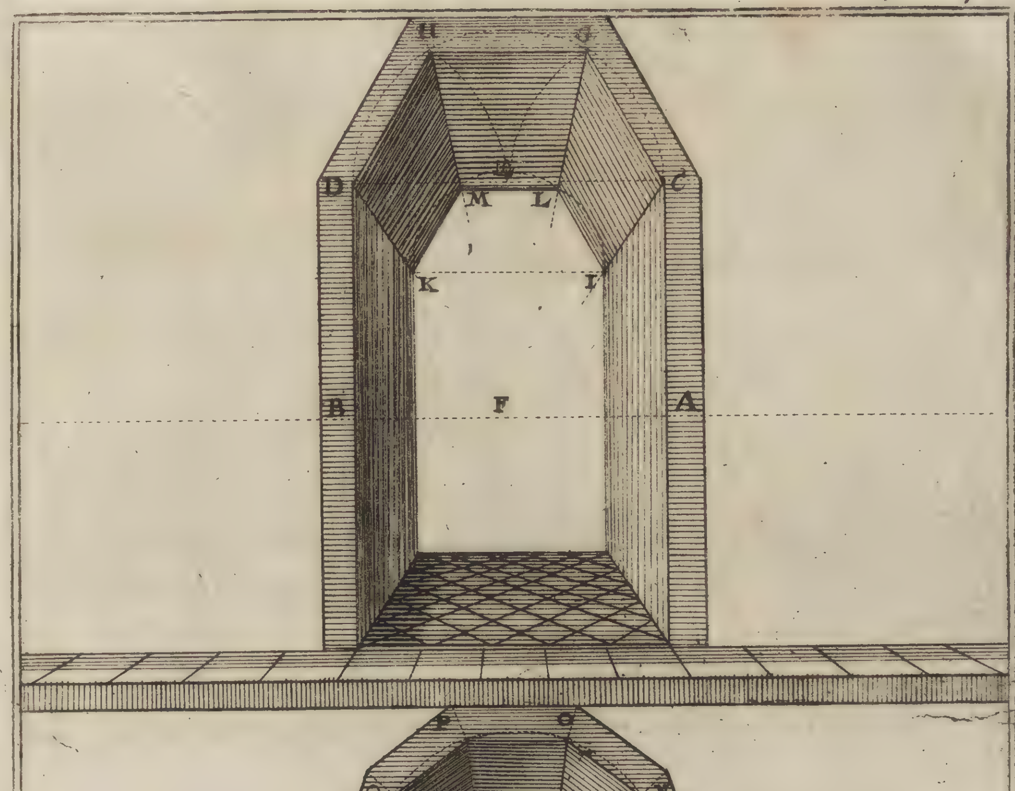
To exhibit Arches *with* three Sides.

THERE is another ſort of cieling which ſometimes ſerves for a vault over doors and galleries, and even churches, having a pretty good effect in perſpective, and eaſy enough to perform. I have added it here after the circle, by reaſon it is formed of a ſemi-circle divided into parts.

Having raiſed the walls A B, deſcribe a ſemi-circle including the whole breadth C D; then holding the compaſſes open to the width of the radius E C, and fixing one point in C, with the other ſtrike an arch upwards, cutting the ſemi-circle in G, and another arch E H from the point D; then connecting the four letters C D G H by right lines, you will have a ſemi-hexagonal arch. A ſemi-circle is likewiſe to be drawn upon the breadth I K, for the bottom of the arch; and to divide it, lines are to be drawn from the angles of the former to the point of ſight F; at the interſections of theſe rays with the lower ſemi-circle, right lines being drawn, will form the arch I L M K.

To exhibit an Arch *with* five Sides.

THIS arch is performed after the ſame manner as the former; all the difference lies in the diviſion of the circle, the firſt being into three, and this into five. Accordingly the ſemi-circle L M being divided into five parts, N O P Q, and lines drawn from all theſe points to the point of ſight R, the reſt is performed after the manner already laid down.


H
G
D
C
M
L
K
I
B
F
A
P
O
Q
N
M
L
R

To exhibit the Elevations *of* Round Objects.

THE desire I have of enabling my reader to put all kind of objects in perspective with the utmost ease, has induced me to shew the method for raising circular figures to any height at pleasure; and the same rule may serve for exhibiting all other rotundo's, as cupola's of churches, amphitheatres, towers, *&c. &c.*

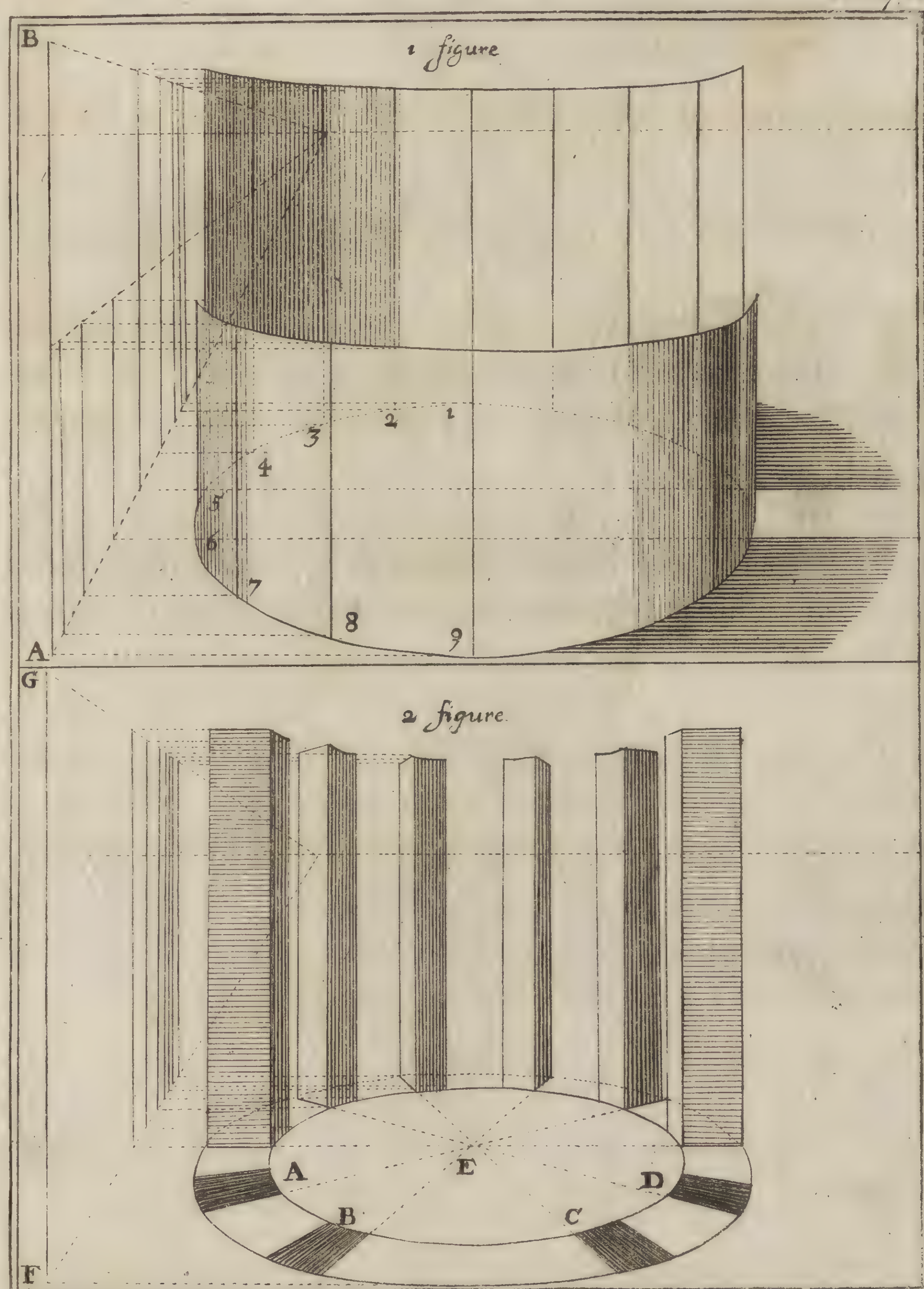
Having put the plan of the round in perspective, as already directed, and raised the line of elevation A B by the side thereof, from the several angles of the plan, which are here the several points whereof the round consists, namely, 1, 2, 3, 4, 5, 6, 7, 8, 9, *&c.* parallels are to be drawn to the ground line, and from their intersections with the line A O perpendiculars are to be raised thereon, as already taught, and the lengths of those perpendiculars transferred upon other perpendiculars, raised from the points 1, 2, 3, 4, 5, 6, 7, 8, 9, *&c.*

The front part of the semi-circle has but half the height of the hinder part, and both the one and the other are mere out-lines without any thickness.

There is no round figure but may be put in perspective by this method. Round figures, I mean, that are parallel to the horizon: for as to such as are perpendicular thereto, they are already taught in the rules for vaults.

For the Elevation *of* Pilasters.

THE circle must be drawn in the plan double, as already shewn in page 29. and between the two circular lines must be placed the plan of the parts or members to be raised, as those here marked A B C D, which all tend towards the center E; then perpendiculars are to be raised from all the angles of these plans, and their proper heights set off from the line of elevation F G; as already shewn in the first figure.

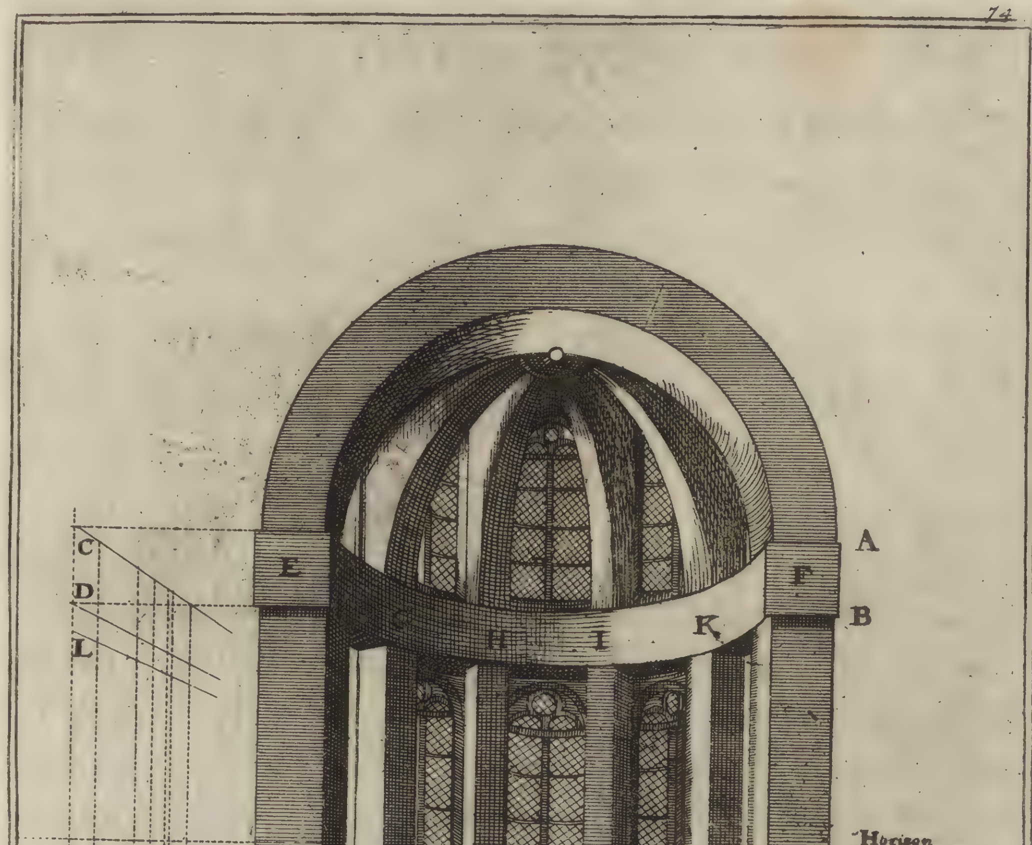

B
1 figure
1
2
3
4
5
6
7
8
9
A
G
2 figure
A
E
D
B
C
F

A Vault *in form of a* Shell, *in* Perſpective.

THIS figure, with little variations, will either ſerve for the *hollow* of a church, or grotto, a *nich*, or the like. The elevation is performed after the manner already directed.

To draw the plat-band, or border A B, which might ſerve for a corniſh, its diminution is to be taken on the line of elevation in C D, and transferred thence to the pilaſters.

For the vault, take the firſt arch E F, as before taught, and in the middle of the inſide deſcribe a ſemi-circle O, to which draw curve lines ſpringing from the pilaſters, and you will have the ribs or reins of the vault, as in G H I K. The heights of the windows muſt be taken on the line of elevation between L and M. For the reſt, ſee the figure.

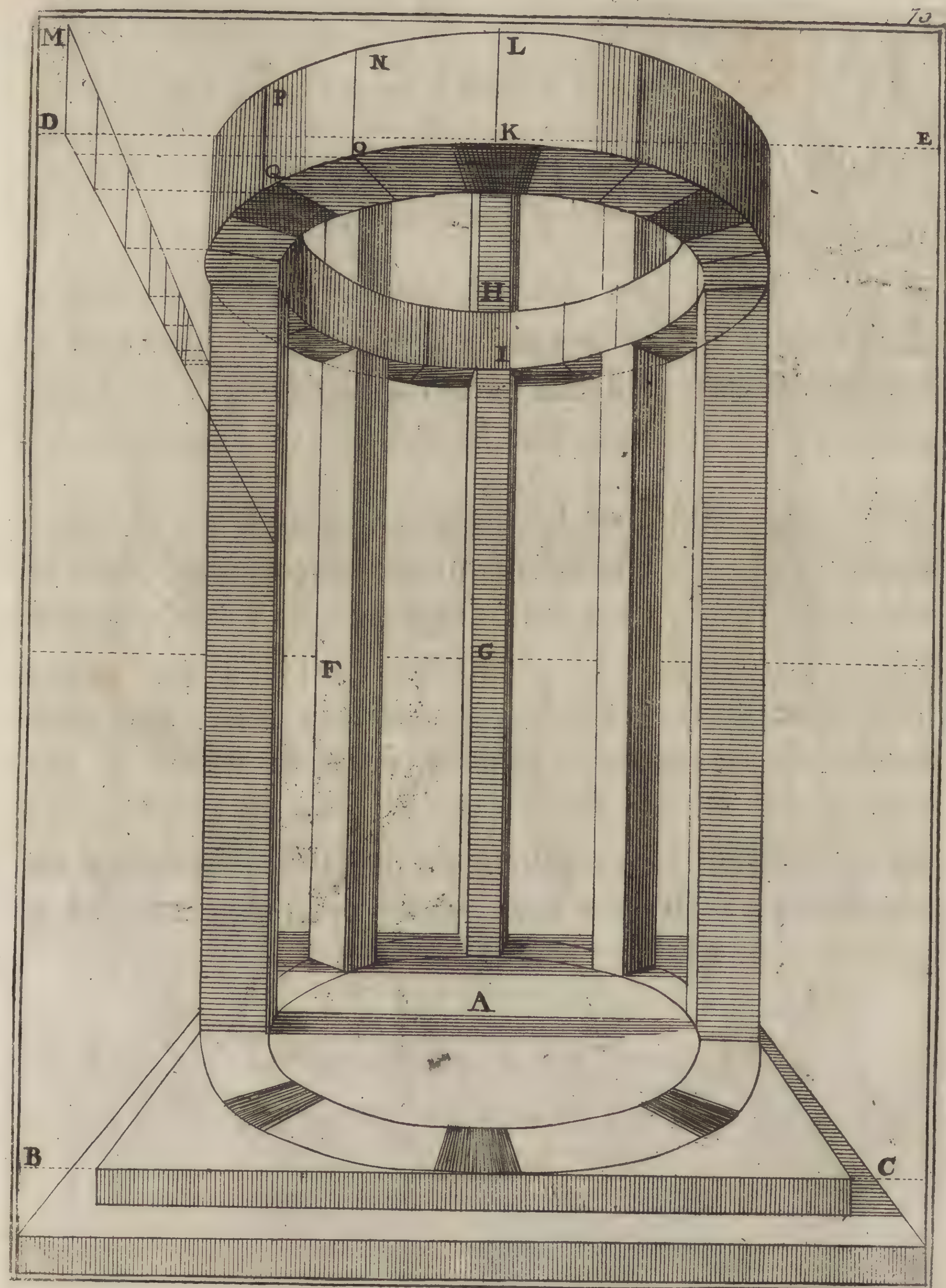

74
C
D
L
M
E
F
A
B
G
H
I
K
Horison
74

To exhibit open DOMES, *o* VAULTS, *in Perſpective.*

HAVING made the plan of a double circle according to page 29, and marked the places of the pilaſters between the two circles, the lines of all of them tending to the center A, ſet off the height intended from the ground to the cavity of the dome, as the line D E, which is to ſerve for a baſe line, upon which the meaſures already laid down on B C drawn parallel to the ground line to touch the circle, are to be placed. Then from the ſame point of ſight G make another plan at the top, like that at bottom, all the places of the pilaſters tending towards the center H. To form the pilaſters, all required is to draw lines from the places oppoſite to each other, which will thus give the breadth and thickneſs. I have drawn no lines for the three front pilaſters, both for the conveniency of ſhewing thoſe behind, and to inſtance that the plan of them muſt be drawn both at top and bottom.

To give the thickneſs of the rotundo from I to H, and from K to L, ſet the intended height on the line of elevation D M, from whence draw lines to the horizon in the point F; and from the ſeveral points of the upper circle draw parallels to the line D F, at their interſections erect perpendiculars, as D M, which are to be transferred thence, with the compaſſes, to the perpendiculars raiſed from the points K L, N O, P Q; and ſo of the reſt.

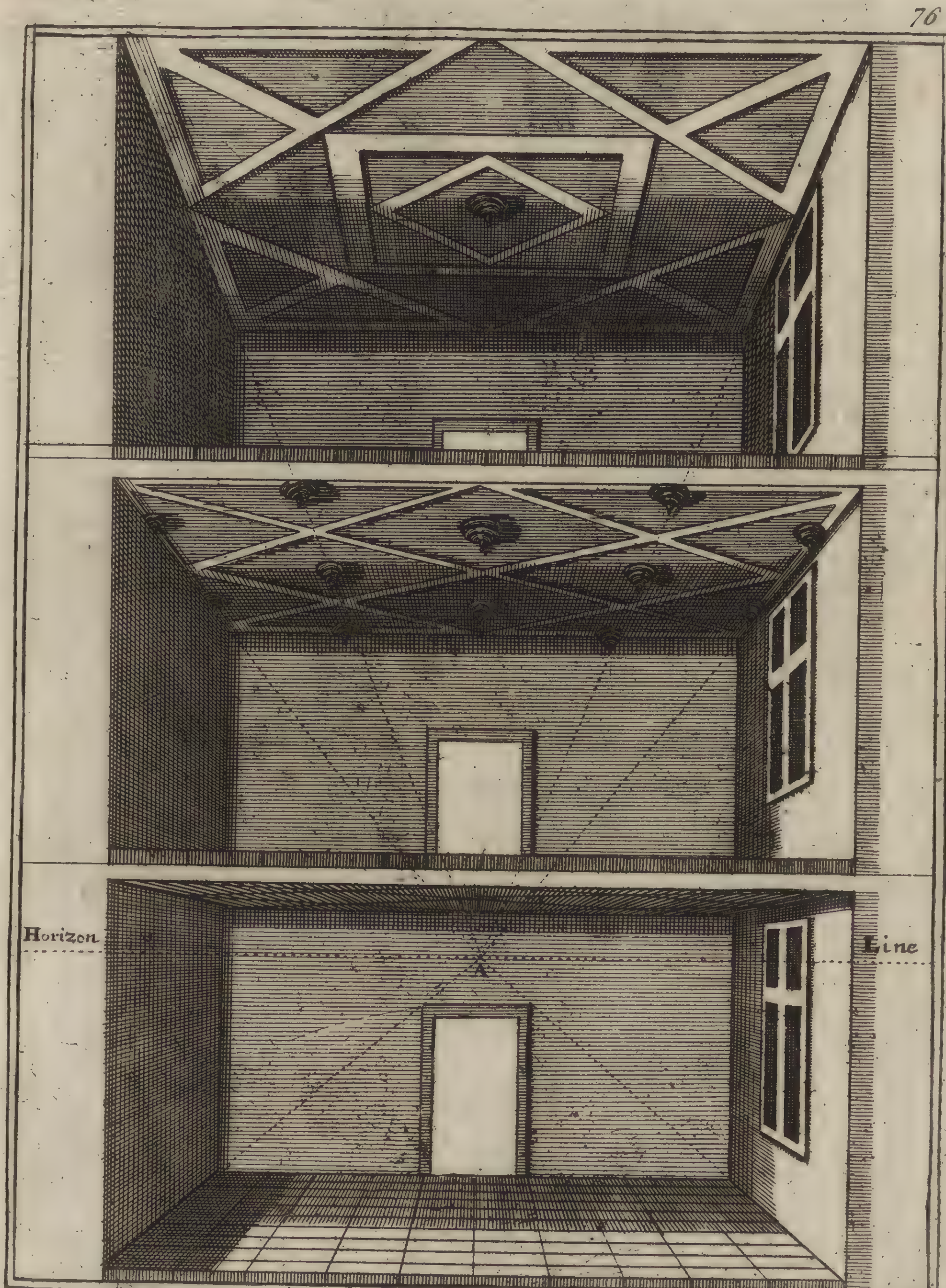
If inſtead of a round you require a ſquare, or polygon, the ſame method is to be obſerved.


M
N
L
P
D
K
O
E
Q
H
I
G
F
A
B
C
75

That a Number of Objects, *and Plurality of* Stories, *only admit of one* Point *of* Sight.

IT has already been obſerved, that only one point of ſight is ever to be uſed in a picture, and that the ignorance of certain painters is publiſhed to all the world, by their making as many points of ſight, and horizons, as they make lines.

It is not long ſince I remember to have ſeen a painting, wherein there were ſeveral rooms one over another, each of which had two or three points of ſight; and yet the painter wonderfully eſteemed his performance. The preſent figure may ſerve to correct this error, and to ſhew, that there ſhould only be one ſingle point of ſight, to which all the objects, and all the rooms, though they were a hundred over or aſide of one another, are to tend. As the three apartments do all here tend to the point A. The reſt is performed by the rules heretofore directed.


76
Horizon
Line
A
76

To put CHIMNEYS *in perſpective, either in the front or ſide-view.*

THE meaſures are to be taken on the baſe line A B, which, to that end, muſt be divided into equal parts. The diviſions may be accounted any thing at pleaſure. The preſent is divided into eighteen, which we call feet.

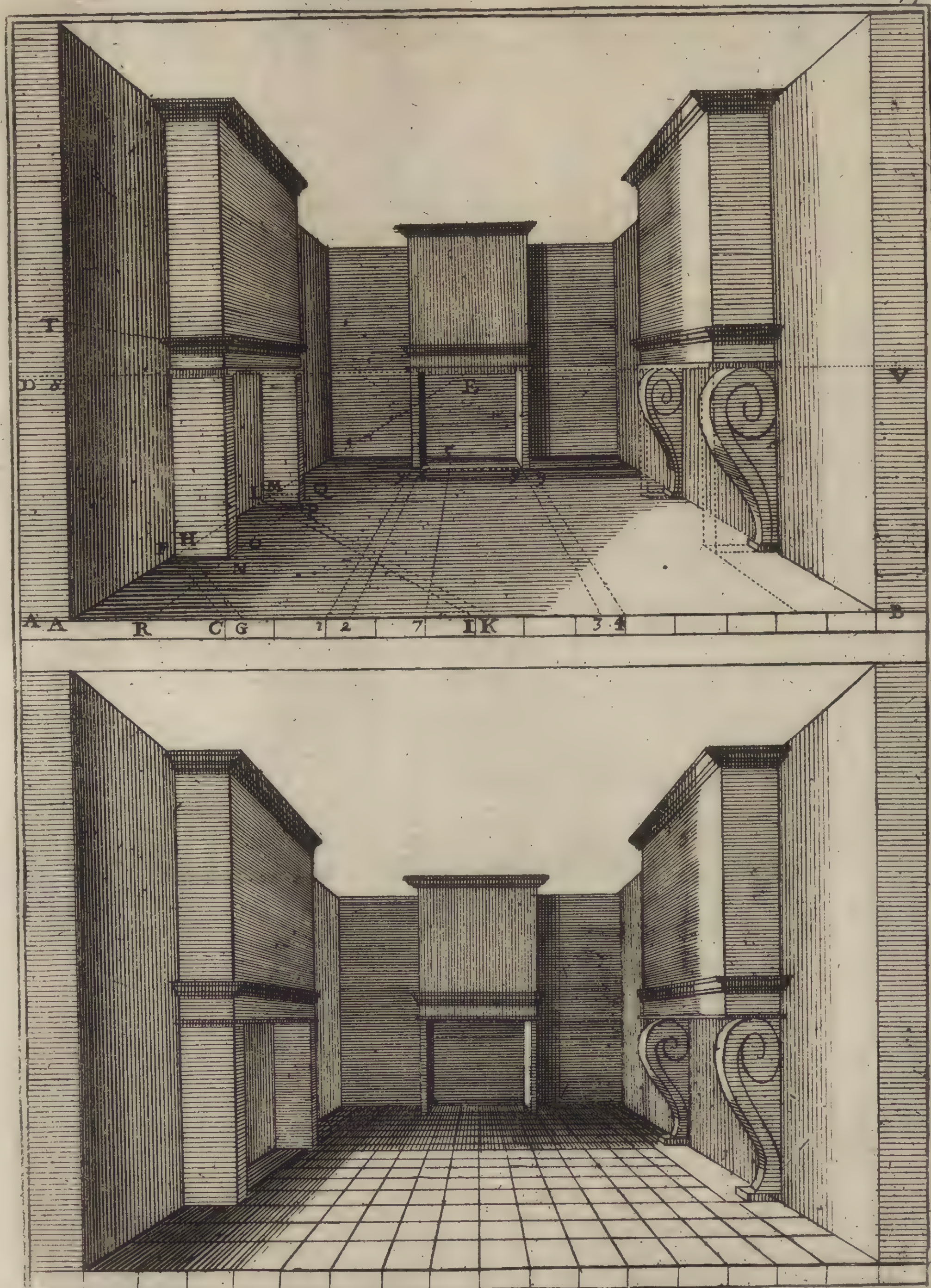
To make a chimney, or fire-place, in a wall, A, three feet within the room, take three diviſions as A, R, C, and from the point C draw a line to the point of diſtance D, which cutting the ray A E in the point F, gives a depth of three feet. Proceed to ſet the thickneſs of the jaumb from C, for inſtance, to G; then drawing a line from G to D, it will give the thickneſs of the jaumb in the point H. Then ſet the breadth of the chimney from G to I, four feet and a half; and half a foot, namely, from I to K, for the thickneſs of the jaumb; then drawing lines from I and K to the point of diſtance D, you will have their meaſures on the ray A E, in the points L M: and from the four points F H L M draw little parallels to the baſe line, as F N, H O, L P, M Q. For the breadth of the jaumbs take a foot and a half, namely, A R, and the ray R E will cut the little parallels in the points N O P Q; from which, and from F L raiſe perpendiculars. For the height of the mantle-tree, take five feet on the baſe line, and ſet them off on the corner of the wall from A to S; and from S to T ſet off the corniſh. All the reſt is obvious from the figure.

The other chimney oppoſite to the firſt is done after the ſame manner. For thus the jaumbs are in all caſes to be managed. And of the jaumbs may occaſionally be made columns, termins, or, as we have here done, conſoles.

To find the hole, or aperture of the chimney, with the depth of the jaumbs, which are a foot and an half, draw a line from 7 to the point of ſight, cutting the line of depth in the point 5, which will be a foot and a half, then, from the point of diſtance V, draw a diagonal through 5, cutting the ray 2 E in the point 6; and from this point draw a parallel, cutting the four rays 1, 2, 3, 4, in the points 9, 6, 9, 9: from which perpendiculars are to be raiſed, and the reſt conducted, as above.

The ſecond figure repreſents what I have been ſpeaking of free and unembarraſſed with lines.

77



77

To exhibit Steps *or* Stairs *in Perſpective.*

THERE is nothing gives a perſpective ſo much grace, or deceives the eye ſo eaſily, as a number of returns and breaks; by reaſon theſe introduce a number of different lights and ſhadows, which give the objects ſuch a force, that they ſeem to project or ſtand out from the ground. Now *ſtairs* have this advantage, that what way ſoever you place them, they have always a variety of ſhades, and of conſequence are agreeable to the ſight. I ſhall add a few inſtances of ſteps in different poſitions by way of ſpecimen.

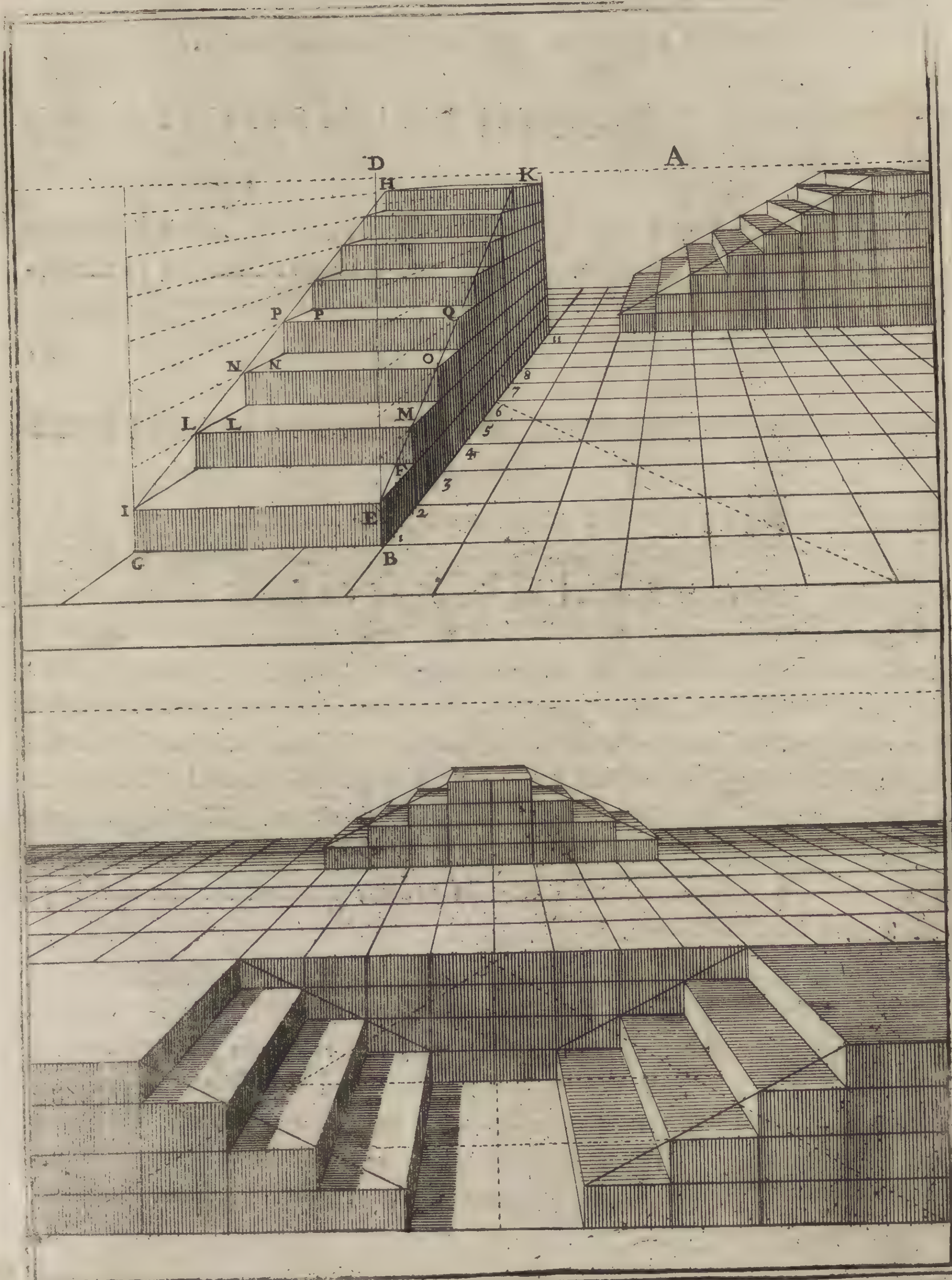
If you make uſe of ſquares, there will be the leſs difficulty, all required being to raiſe perpendiculars of as many ſquares as you would have ſteps; then to ſet the line of elevation, divided into any number of parts, on the firſt ſquare, and from the diviſions to draw lines to the point of ſight, which will interſect the perpendiculars in the places where the ſteps are to be.

It is deſired, for inſtance, to conſtruct a ſtair-caſe of eight ſteps, the laſt of which to be the breadth of three feet. Take the number of ſquares of the plan, beginning at B, and proceeding 1, 2, 3, 4, 5, 6, 7, 8, and allowing three for the laſt marked 11, from all theſe angles erect perpendiculars, to be cut according to the diviſions on the line of elevation B D, in manner following.

The firſt diviſion, which, ſuppoſing the ſquare to be a foot, is four inches high, will cut the firſt perpendicular, and muſt be continued to 2, which makes the top of the ſtep; and ſo of the reſt. The ſteps you may make as long as you pleaſe, by ſuppoſing the ſquare a foot. Accordingly the uppermoſt here, taking three diviſions, is three feet. Perpendiculars ſhould likewiſe be raiſed, as in this inſtance, on the ſide B: but that trouble may be ſaved, by taking the height of the laſt ſtep H, and that of the firſt I, and drawing the line H I, raiſing the angles on the ſide I, as E K does on the ſide B; for this done, you need only to draw parallels to the baſe line from all the ſtairs from the ſide B, to cut the line H I in L M N O P Q, &c.

One might likewiſe do without making ſquares; for laying all the meaſures on the baſe line, and drawing lines from them to the point of diſtance, the ſame meaſures would be had on the line A B.

The other figures we are ſilent upon, this much being ſufficient for the underſtanding and executing them all.


D
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B
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3
4
5
6
7
8
11
78

STAIRS *open or perforated underneath.*

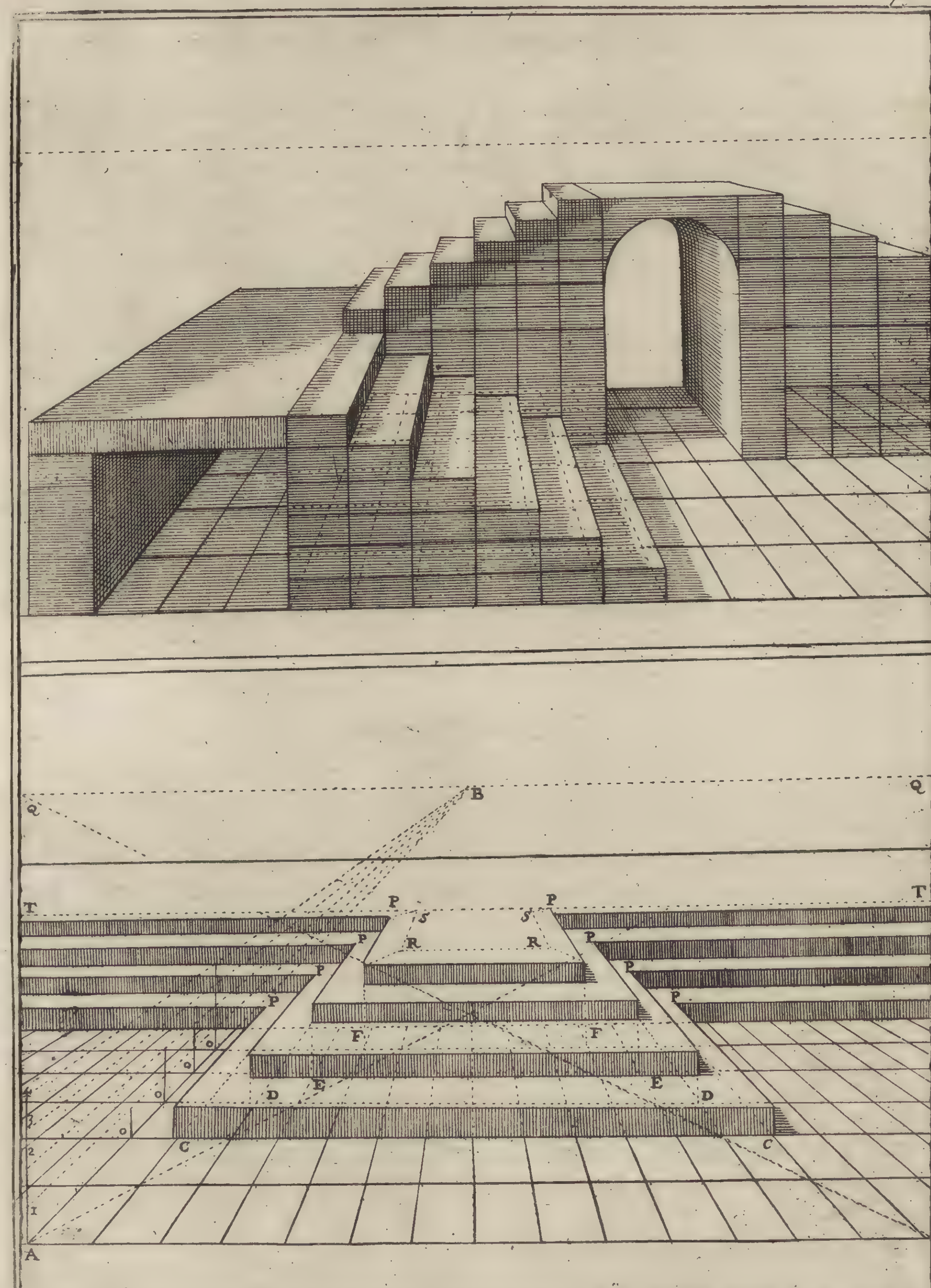
THE method of managing theſe ſtairs is the ſame with that already deſcribed.

As to the aperture, a bare ſight of the figure is ſufficient to ſhew how it is to be put in perſpective. Theſe two may give occaſion to the inventing many others.

STEPS *or* STAIRS *viewed in Front.*

THIS method is founded on the uſe of the line of elevation: the ſame number of perpendiculars are to be raiſed from the angles of the ſquares of the plan, as there are required ſteps, for example, C D E F; and from the ſame angles parallels are to be drawn to the ground line meeting the line of elevation A, the interſections whereof give the points O O O O, from which perpendiculars are to be raiſed till they cut the occult rays of the diviſions of the line of elevation. Theſe meaſures are to be taken in your compaſſes, and ſet off on the perpendiculars raiſed from the angles of the plan, each in its order; the firſt for the firſt ſtep, the ſecond for the ſecond, *&c.*

To find the returns P P, *&c.* from the ſame angles P, *&c.* lines are to be drawn to the point of diſtance Q, and notice taken where they cut the line of the plan, or the bottom of the ſtep; for inſtance, over the fourth ſtep is the plan of the fifth: now to find its return P, from the point P draw a line to Q, and the point S, wherein it interſects the parallel R R, will be the line of return S T; and ſo of the reſt.



79

To exhibit STEPS *that ſhew four Sides.*

THERE are various manners of ordering ſuch ſteps, two of the eaſieſt of them follow. Take the length of the firſt ſtep, and ſet the number of ſteps required upon the ſame; as on the line A B are here ſet the points C C C C, for four ſteps. From theſe points draw rays to the point of ſight D, which rays are to be cut by the diagonals A F and B E in the points I I I, from which perpendiculars are to be raiſed, and parallels to the ground line drawn to the line of elevation G, which give the points H, to be raiſed as H K.

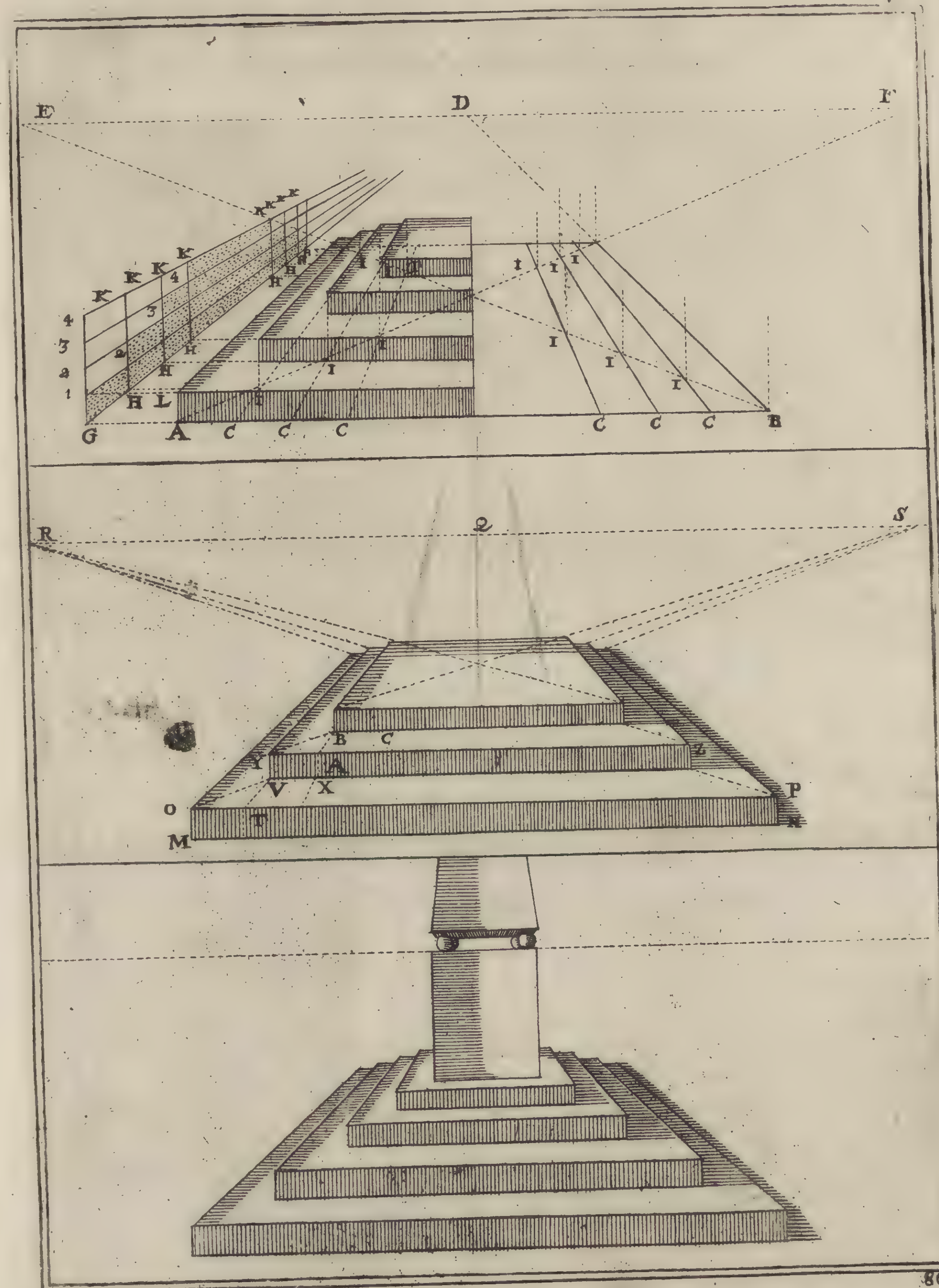
On this line of elevation G, as many equal parts muſt be marked as there are ſteps deſired, for example, four, here marked 1, 2, 3, 4. From theſe four points of diviſion rays are to be drawn to the point of ſight D, to cut the perpendiculars H K, and give each its proper height.

Theſe meaſures muſt be taken in your compaſſes, and transferred one after another, beginning with the firſt G, which is to be ſet on the firſt perpendicular on the angle A, namely A L; then a parallel to be drawn to the other ſide B, (though here I only give half of it, to have room for the plan in the other.) For the ſecond ſtair the ſecond meaſure H 2 is to be taken, and ſet off on the ſecond perpendicular I; and a parallel is to be drawn as before; and ſo of the reſt.

Another Manner.

THE ſide M N being given, make a parallel O P over the ſame, for the thickneſs or height of the firſt ſtep. From the two points O P draw two rays to the point of ſight Q, and again other lines to the points of diſtance R S; which laſt will give a ſquare after the uſual way, and form the firſt ſtep. For the ſecond, ſet the intended breadth on the line O P, for example, O T, and from T draw a ray to the point of ſight Q; which line or ray T Q will cut the diagonal O in the point V, the place where the ſecond ſtep muſt be raiſed. The height of this ſecond degree muſt be half of V X, as M O is half of O T. The point Y thus gained, a parallel muſt be drawn through it as far as the diagonal of the other ſide drawn from the corner P; then from Y and Z draw lines to the points of ſight and diſtance, to form the ſquare, as for the firſt ſtair. For the third, ſet the meaſure V X on the line Y Z, extending, for example, from Y to A; and from the point A draw a ray to the point of ſight Q, which interſecting the diagonal of the point Y, will give the point B for the third ſtep. Its height will be half of B C, which is always that of O T in perſpective. The reſt the ſame as in the firſt and ſecond.

The third figure ſhews theſe ſtairs free of all the confuſion of lines and letters.


E
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N

Stairs *or* Steps *viewed ſidewiſe in Perſpective.*

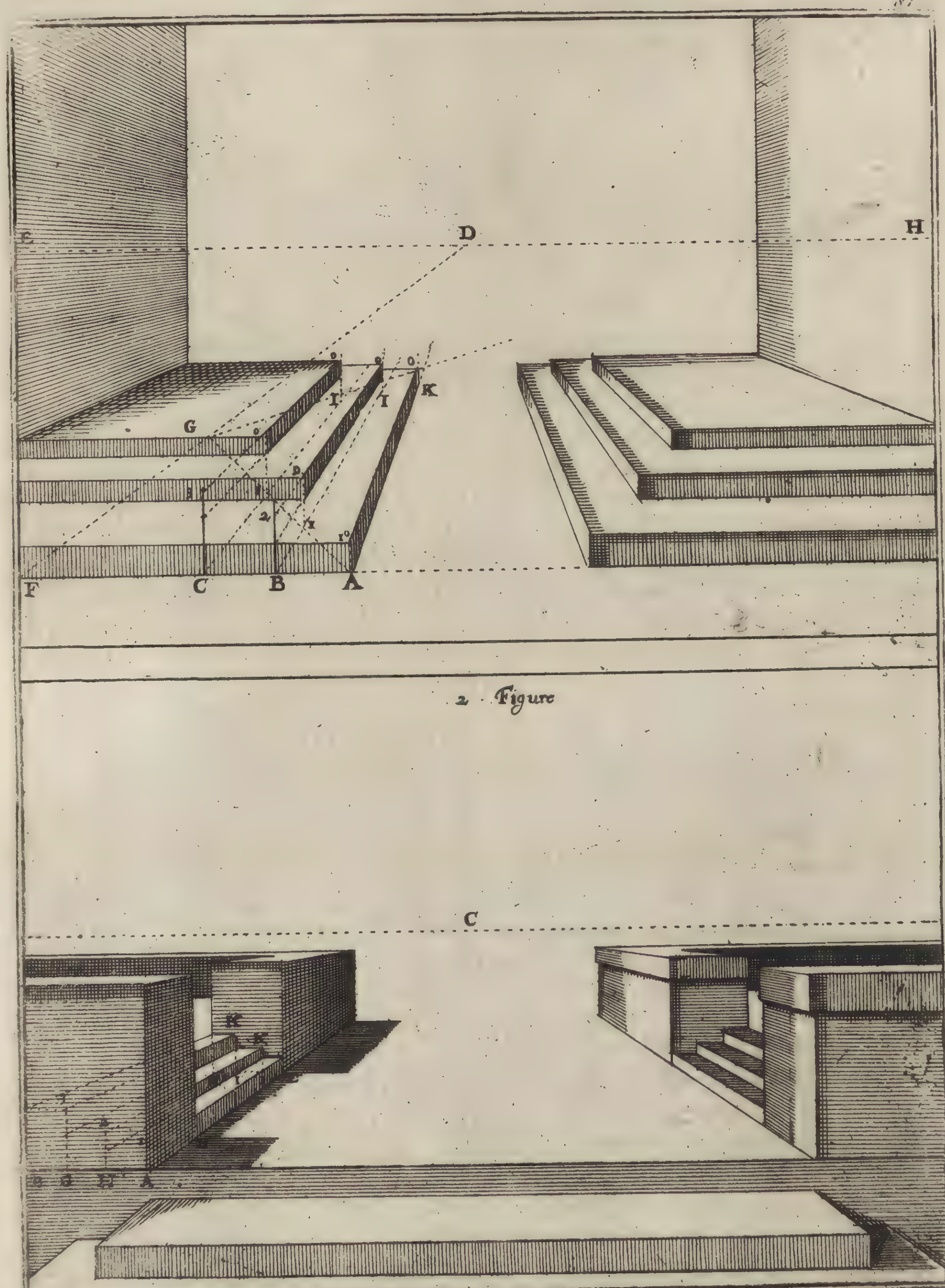
THE number of ſtairs is firſt to be laid down on the baſe line, that is, ſo many points are to be made thereon at equal diſtance as you intend ſteps; as in the preſent caſe A B C. From theſe points lines are to be drawn to the point of ſight D; then from the point A, another is to be drawn to the point of diſtance E, which diagonal A E will give the plan, and the place of the ſtairs, by its interſection with the rays B D, C D in the points I; and by its interſection with the ray F, which is the foot of the wall, it will give the point G, which is the middle of the plan of the ſtairs. From G a line is to be drawn to the other point of diſtance H, which gives the angle of the laſt ſtair in the point K, and the place of all the reſt in the points II. Laſtly, from all the points I, erect perpendiculars.

Now to give the heights; from the points A B C on the baſe line erect little lines, ſerving for a line of elevation; on theſe lay the heights according to their number. The perpendicular A, for inſtance, which is the firſt, will only have 1; B, the ſecond, will have 2; and C, the third, will have 3. From all theſe points 1, 2, and 3, draw lines to the point of ſight D, and you will cut the perpendiculars raiſed from the plan in the points O, which will give the height of each ſtep.

The draught on the other ſide ſhews the ſteps free of points and lines. The ſame method may ſerve for divers purpoſes; as for the ſteps of an altar, a throne, the front of a church, a gate, *&c.*

Stairs *in a* Wall *in Perſpective.*

MAKE as many diviſions at the end of the baſe line as you intend ſtairs, as in this caſe, three between A and B, and from A and B draw lines to the point of ſight C; then, having determined the ſpace the ſtairs are to take up, as D E, a parallel to the baſe line E F muſt be drawn, which in the points I I will receive the interſections of lines drawn from the points G H to the point of ſight C; and from the ſame points I I, perpendiculars I K, I K are to be erected, to receive the heights of the ſtairs, by drawing points 1, 2, 3, to the point of ſight C, as appears from the figure.



2 Figure

To exhibit a Stair-Case *with* Landing Places *in Perſpective.*

DO but recollect the preceding methods, and you will find it exceeding eaſy to conſtruct ſuch ſtair-caſes. However, to ſave the trouble of too irkſome a retroſpect, I ſhall explain the whole here.

By reaſon ſtair-caſes of this figure uſually run over a ſpace equal to twice their width, to raiſe one of them in perſpective, the horizon muſt firſt be diſpoſed at pleaſure; then a ſquare to be made according to the common rules, and this to be doubled, as directed in page 16; then divided by an unequal number of ſmall ſquares, that the wall, which is ſuppoſed in the middle, may be the meaſure of a ſquare.

In this figure each ſquare has nine ſides, or ſquares, on either hand, which being doubled, give eighteen; of theſe, four being left at each end for the landing-places, remain ten ſquares, or ſtairs, each whereof we ſuppoſe equal to a foot every way.

At the diſtance of four ſquares from the point A, erect the perpendicular B pretty high, then a ſecond perpendicular C at the other angle of that ſquare, and a third D; and ſo onwards on the other angles of the ſquares, to the number of ten. This done on one ſide, the ſame muſt be repeated on the other; and ſuch perpendiculars will give the depths or breadths of the ſteps.

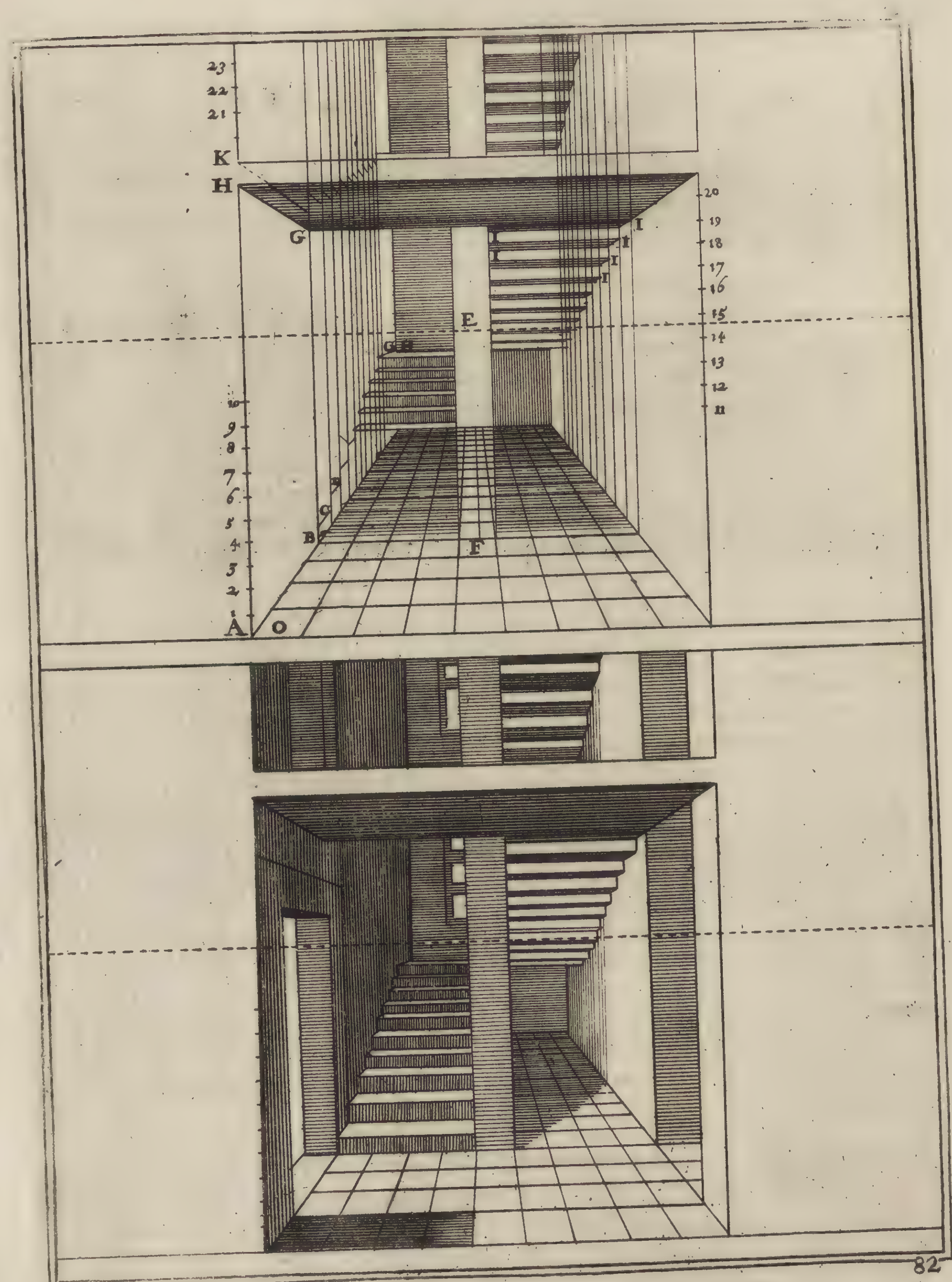
For the heights, if they be a foot broad, they muſt be half a foot high, or half the little ſquare A O; which height being taken in your compaſſes, ſet it on the firſt angle, which is to ſerve for a line of elevation, beginning at the bottom, or the point A, and making as many diviſions thereon as you intend ſtairs, namely ten, from the bottom to the firſt landing-place; where you begin to mount up the oppoſite ſide, and the ſeries of numbers is continued to twenty-three.

From all theſe twenty-three points, lines are to be drawn to the point of ſight E, and care taken to cut the perpendiculars in their order; that is, having laid your ruler from the firſt point to the point of ſight, croſs the firſt perpendicular B to C with a little ſtroke, for the firſt ſtep. For the ſecond ſtep, from the ſecond point draw a line, croſſing the ſecond perpendicular C to D. And ſo of all the reſt on both ſides.

From the angles of all theſe little ſtrokes between the perpendiculars draw parallels to the horizon, as far as the wall F erected in the middle; ſuch are the lines IIII, which I have only added on one ſide, to avoid confuſion: It is theſe parallels alone that form the ſtairs. All the other lines hitherto drawn ſhould be occult, and not to be ſeen when the figure is finiſhed.

The landing-places ſhould contain all the vacant ſpaces between the laſt perpendicular and the wall, as from G to H. Their height, or thickneſs A K, is half a foot, the ſame as that of a ſtair.

The lower figure is the ſame with the upper, only that one has the apparatus of lines, &c. neceſſary for the performance, which the other is without.


23
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21
K
H
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I
I
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19
18
17
16
15
14
13
12
11
E
G H
10
9
8
7
6
5
4
3
2
1
B
C
F
A
O
82

To exhibit Winding *or* Spiral STAIRS *in Perſpective.*

ONE ſide of the flight, or aſcent, is to be ſet on the baſe line, and divided into as many parts as you require ſtairs. Suppoſe, for inſtance, A B the ſide of the ſtair caſe, and ſixteen ſteps required in the whole circuit of the ſquare; each ſide, in this caſe, will contain four; conſequently A B being divided into four, a ſquare is to be formed thereof, as here repreſented, divided into ſixteen, according to the uſual rules.

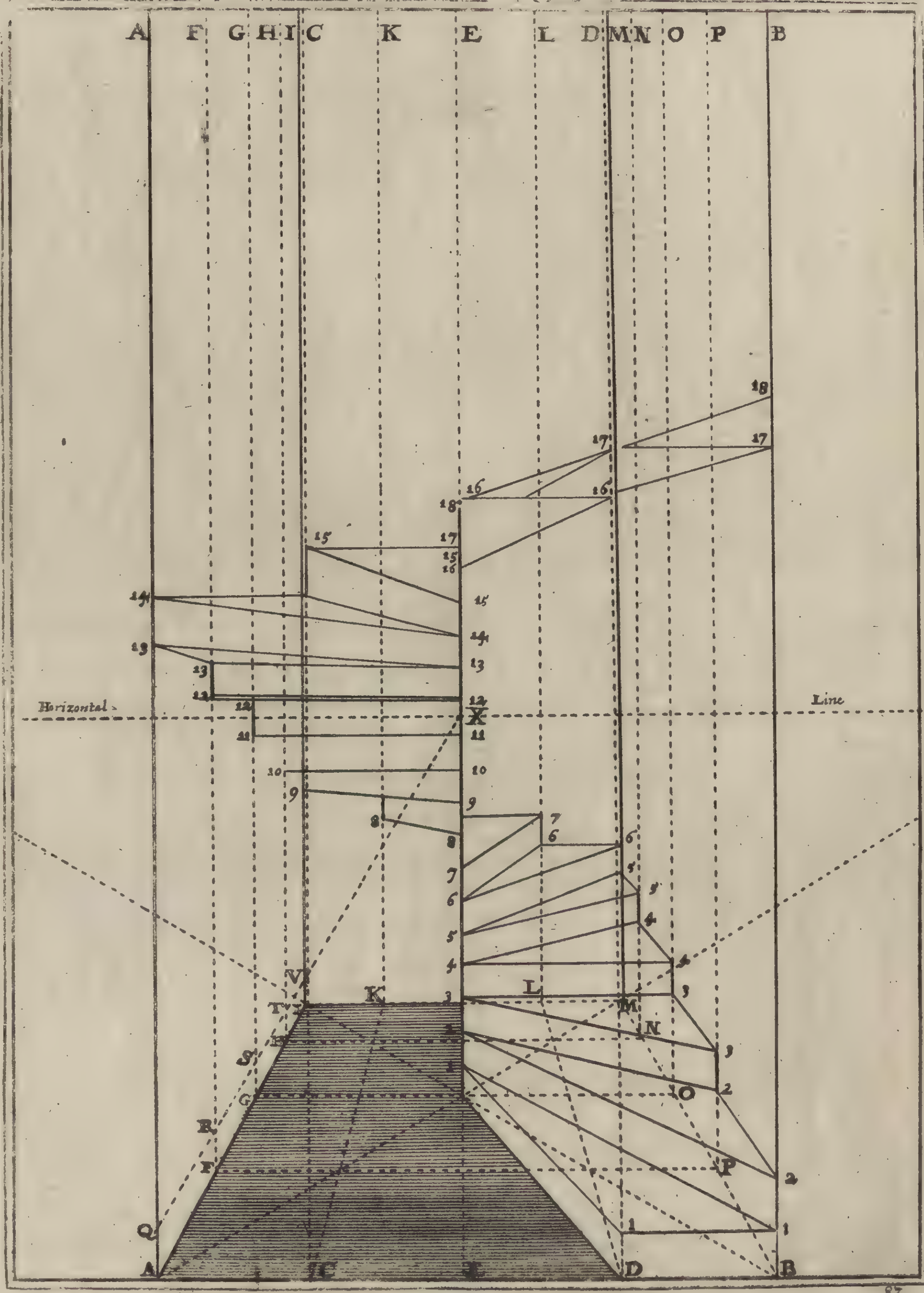
From all the diviſions on the ſides of the plan, perpendiculars muſt be raiſed to give the bounds of the ſtairs. Suppoſe then the perpendiculars A A, B B, C C, D D, E E. Thus E E ſtands for three of the perpendiculars, by reaſon the point is in the middle, and ſerves as a newel, * or common center of them all. On the firſt perpendicular A, which is to ſerve for a line of elevation, the height of a ſtair Q A muſt be ſet, and from the point Q a line be drawn to the point of ſight X, which by its interſections with the perpendiculars Q R S T V, gives the dimenſions of all the ſtairs. Thus A Q is the height of the firſt, F R of the ſecond, G S of the third, H T of the fourth, and I V of the fifth. This laſt is the height of all thoſe at the bottom, as A Q is of thoſe in the front.

Since G S is the meaſure of the third, which is that in the middle of the ſide, it muſt likewiſe be the meaſure of the center, and of the newel of the flight: for this reaſon, having taken the meaſure G S in your compaſſes, ſet it off in the center of the ſquare or the newel as many times as you would have ſtairs in the flight; for example, eighteen times for eighteen ſtairs.

All things thus diſpoſed, the reſt is eaſy. For the firſt ſtep you are to take the diviſion A Q, and ſet it off upon the perpendicular D in the point 1, and from 1 to draw a parallel to the perpendicular B; then from the two points 1 1 draw lines to the third 1 at the newel or center of the ſquare. Theſe three 1 1 1 will form the firſt ſtair. For the ſecond, ſince its angle reaches to the perpendicular B, which is on the fore-ſide, it muſt have the ſame meaſure A Q, which will be 1, 2; then from the point 2 a line is to be drawn to the point of ſight X, cutting the perpendicular P in the point 2; from which points 2 and 2, lines are to be drawn to the 2 at the newel. Thus will you have formed the ſecond ſtair. For the third, ſince it is found on the perpendicular P, the meaſure F R muſt be taken for its height; and the ſame proceſs obſerved as in the former.

If you would have them round withal, the ſquare muſt be reduced to a circle; according to the preceding rules: and for the reſt, the ſame method will ſerve for both.

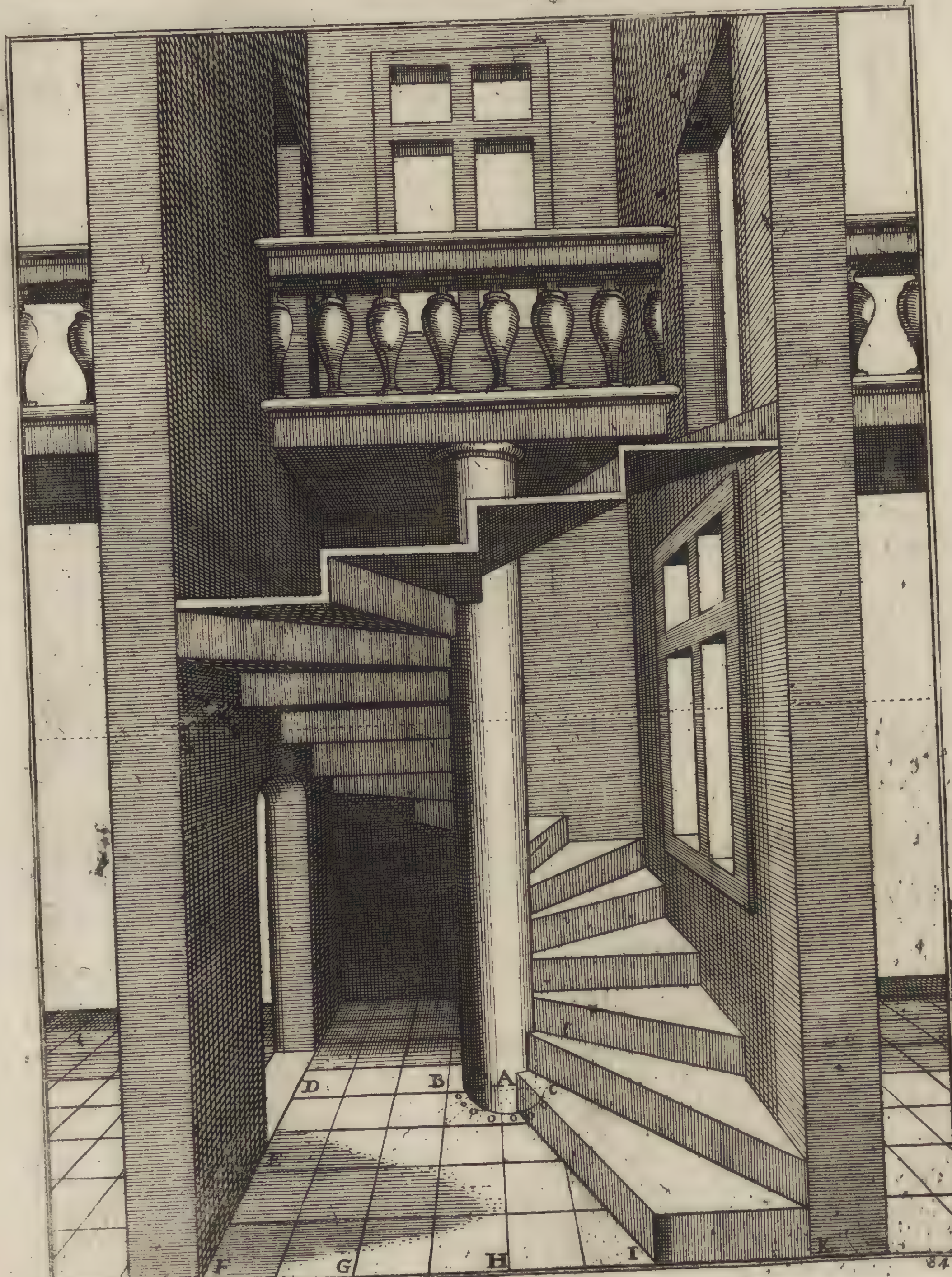
* The newel is the upright poſt which a pair of winding ſtairs turns about.


A F G H I C K E L D M N O P B
Horizontal
Line
X
V
T
S
R
Q
A
C
E
D
B
83

WINDING-STAIRS.

THIS figure is the ſame with the preceding one, which was not ſhaded, that the method of the operation might be the more conſpicuous. For the ſame reaſon the newel of the ſtair caſe was reſerved for this figure. It is formed by aſſuming the point A as a center, and thence deſcribing a circle; or rather a ſemi-circle, as B C, becauſe only half of it is to be ſeen. To the center of this ſemi-circle lines muſt be drawn from all the diviſions of the ſquare of the firſt plan, as DEFGHIK, which will cut the arch B C into eight parts; and from the interſections O O, &c. perpendiculars are to be raiſed; taking care they cut preciſely in the points, where the ſteps are placed; the ſtep I, for inſtance, to be cut by the perpendicular raiſed from its point in the ſemi-circle, as in A; the ſecond ſtep to be cut by the perpendicular raiſed from the point which K gives in the ſemi-circle: and ſo of the reſt.

The doors, windows, &c. in the figure, are all conſtructed according to the rules already laid down.


D
B
A
C
E
F
G
H
I
K
84

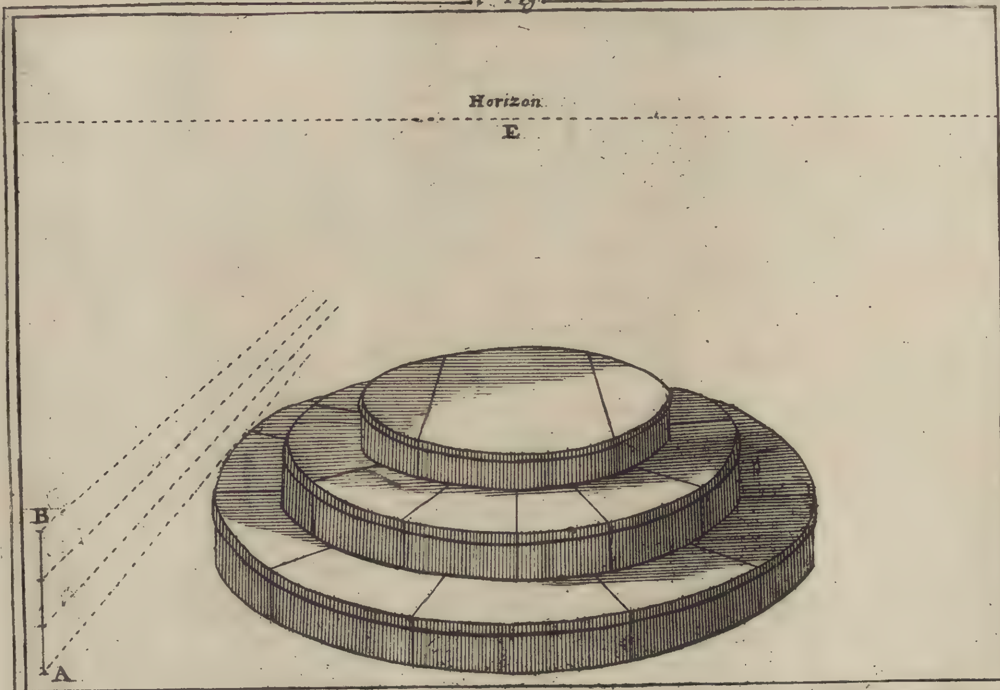
To exhibit Round Stairs *in Perſpective.*

TO raiſe theſe three round ſtairs or ſteps, in a front view, make a plan of three circles within each other, after the manner already directed in page 28, and from the ſeveral points that form the circle draw lines parallel to the baſe, as far as the ray A, which is the foot of the line of elevation A B. This gives the elevations, which are to be taken thence with the compaſſes, and ſet off on perpendiculars raiſed from the ſeveral points of the plan.

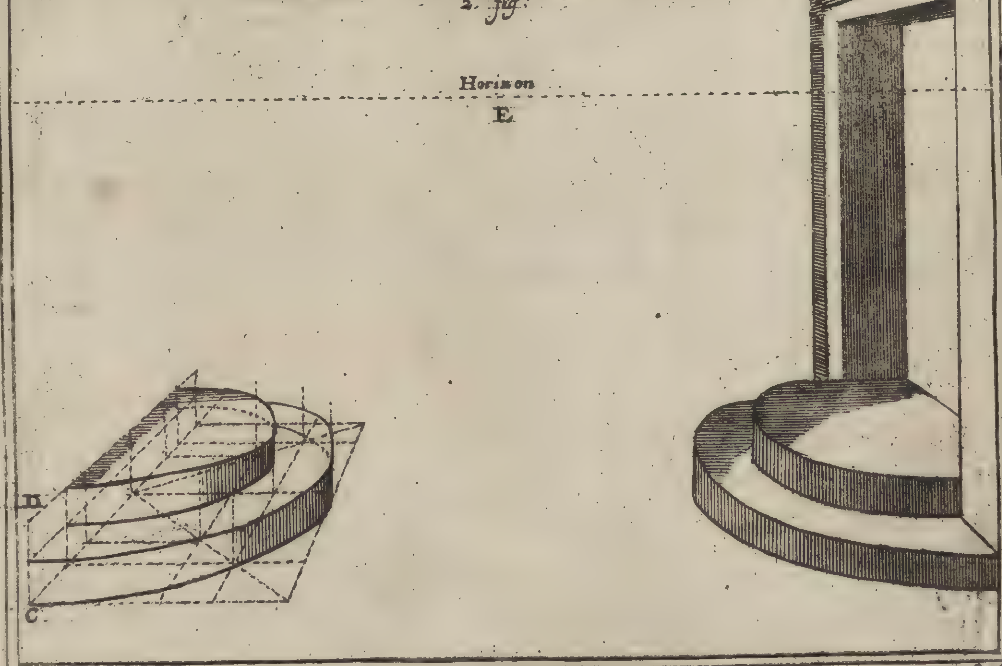
Round Steps *viewed ſide-wiſe.*

THE rules for objects viewed by the ſides I have often obſerved are the ſame with thoſe for objects in front. However to ſhew we are not always obliged to obſerve the diviſion of the circle into ſixteen, theſe of the ſide-view we have divided into eight. For the reſt, it is the ſame as in the preceding caſes, the line of elevation is C D, drawn to the point of ſight E.

1 Fig.



2. fig.



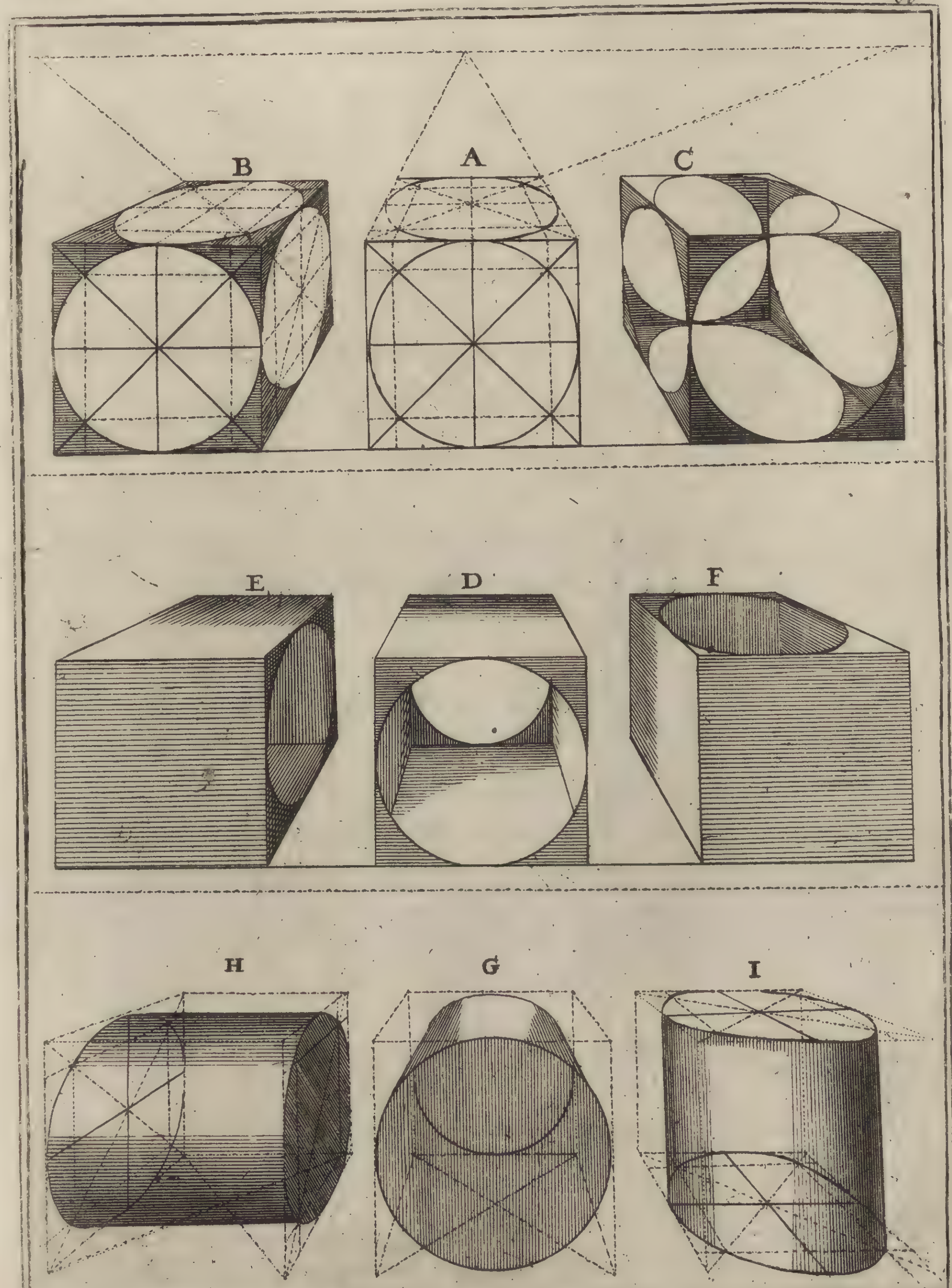
To exhibit SQUARES, *with* Circles *therein, in Perſpective.*

THE method for this proceſs, is the ſame with that delivered for putting planes in perſpective. The circle, for inſtance, is to be divided into eight parts, as in figure A, wherein the circle on the front of the cube, gives the diminution of that on the top; and that in the front, with that at top, give the diminutions of all the other ſides; as in figure B, where the circle is alſo diminiſhed on the ſide, and in the figure C, where it is diminiſhed on three ſides of the cube, I mean both on the outer and inner ſides.

The three figures D E F are perforated each on two ſides, according to the plan of the circle A. Thus the cube D is pierced through its fore-ſide; and through that perforation the bottom is ſeen. Thus alſo E is perforated on the ſides, and F through the top and bottom, though the latter perforation be not diſtinguiſhable, by reaſon the object is not ſuppoſed tranſparent.

The three figures underneath repreſent the pieces cut out of each cube. G, for inſtance, out of the cube D. H out of E, and I out of F.

Upon the whole, the method of diſpoſing ſquare figures in circles appears very eaſy; nor can the attentive reader find any difficulty in placing columns under any diſpoſition whatever. The reaſon why I have yet given no directions for them, is, that I choſe to render the raiſing of elevations as eaſy to conceive, and the practice as little embarraſſed as poſſible. Thus much may ſerve for the beginning of columns; how to carry on and finiſh them ſhall be ſhewn hereafter.


B
A
C
E
D
F
H
G
I
86

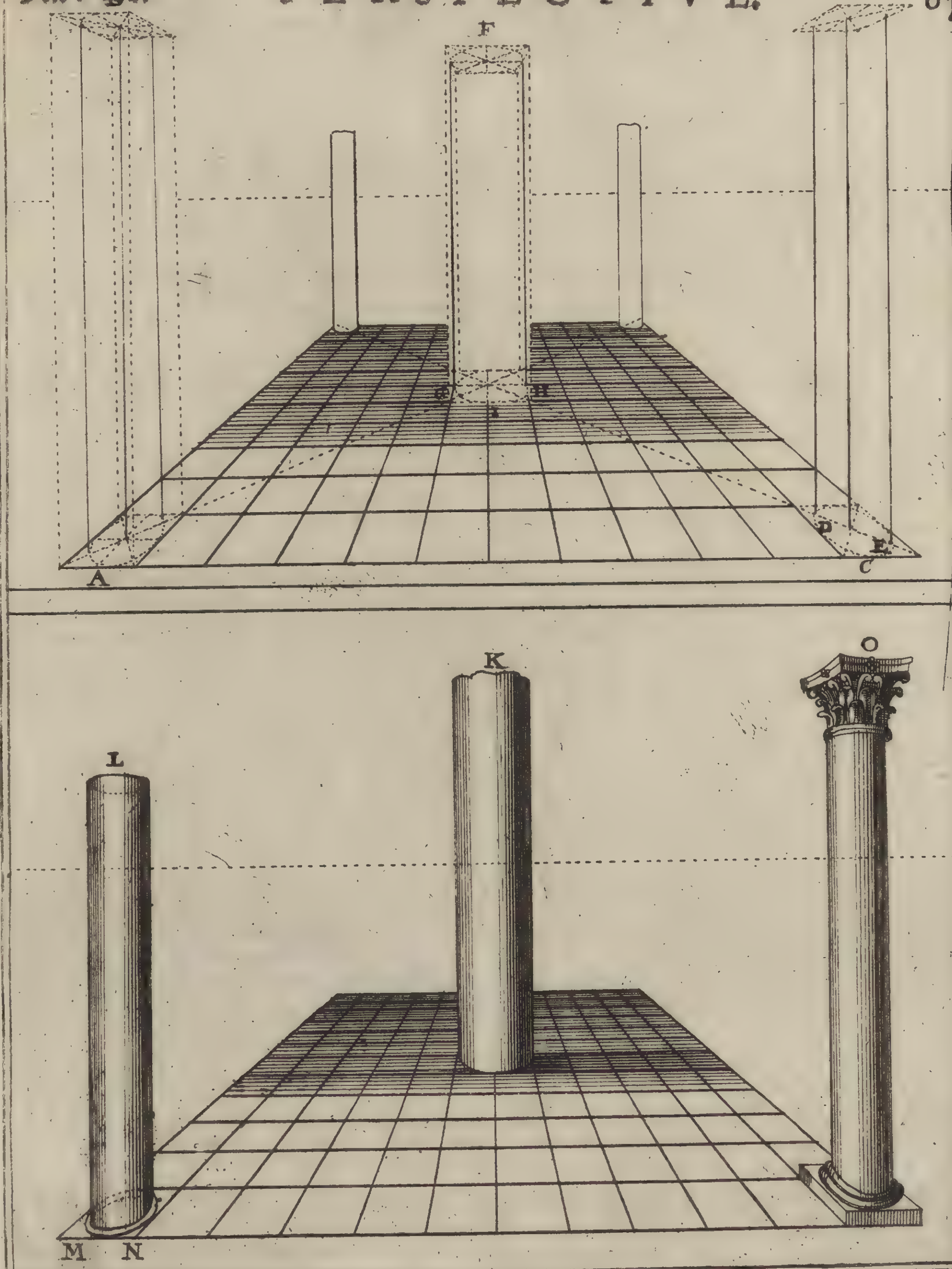
To exhibit COLUMNS *in Perſpective.*

WHAT has been juſt obſerved is not confined to the cube, but extends equally to any object which is to be rounded. For inſtance, if from the ſquare, A, you would raiſe a column A B, deſcribe a circle within the ſquare, according to the common rules; and at the intended height deſcribe another ſquare with a circle within it, B. Now to get the two lines D E, which make the thickneſs, or diameter of the column, obſerve where the circle cuts the diagonal of the ſquare, and on thoſe points raiſe the lines which form the ſides of the elevation. Thus C is formed by perpendiculars raiſed from the interſections D E of the circle with the diagonal of the ſquare.

Thus much regards the column in ſide-views. As to thoſe in front, for example, the figure F, they always ſhew the ſemi-circle G H I, and for this purpoſe the perpendiculars are to be raiſed from the extremes of the diameter G H; and in both thoſe in front, and thoſe in ſide-views, perpendiculars to be raiſed from the center, to give the diminutions.

As to the three columns underneath, as they ſhew the former inſtances more clearly, and with the addition of ſhadowing, they likewiſe ſerve to point out the manner of proceeding to finiſh the *columns*. The middle figure, K, is quite round, without any ornament at all, and being viewed in front, is raiſed by perpendiculars from the extremes of the diameter. The ſecond, marked L, ſhews, that when a baſe is required, a double circle muſt be deſcribed on the ſquare that ſerves as a plinth, whoſe upper part is M N; the interval between the circles to be the projecture of the baſe, and the inner circle the plan of the baſe, from which perpendiculars are to be raiſed.

The third figure, O, is a column with its ornaments; which every one is to make at his diſcretion; taking care the abacus anſwer, as it ought, to the plinth. Theſe two columns L and O being ſeen ſidewiſe are raiſed by perpendiculars from the points where the circle cuts the diagonals of the ſquare.



87

Cornices *and* Mouldings *in Perſpective.*

AFTER the *columns*, which are the chief ornaments of architecture, we proceed to the *cornices*, or *mouldings*, with their projectures; which have hitherto been omitted, for fear of rendering our elevations perplexed.

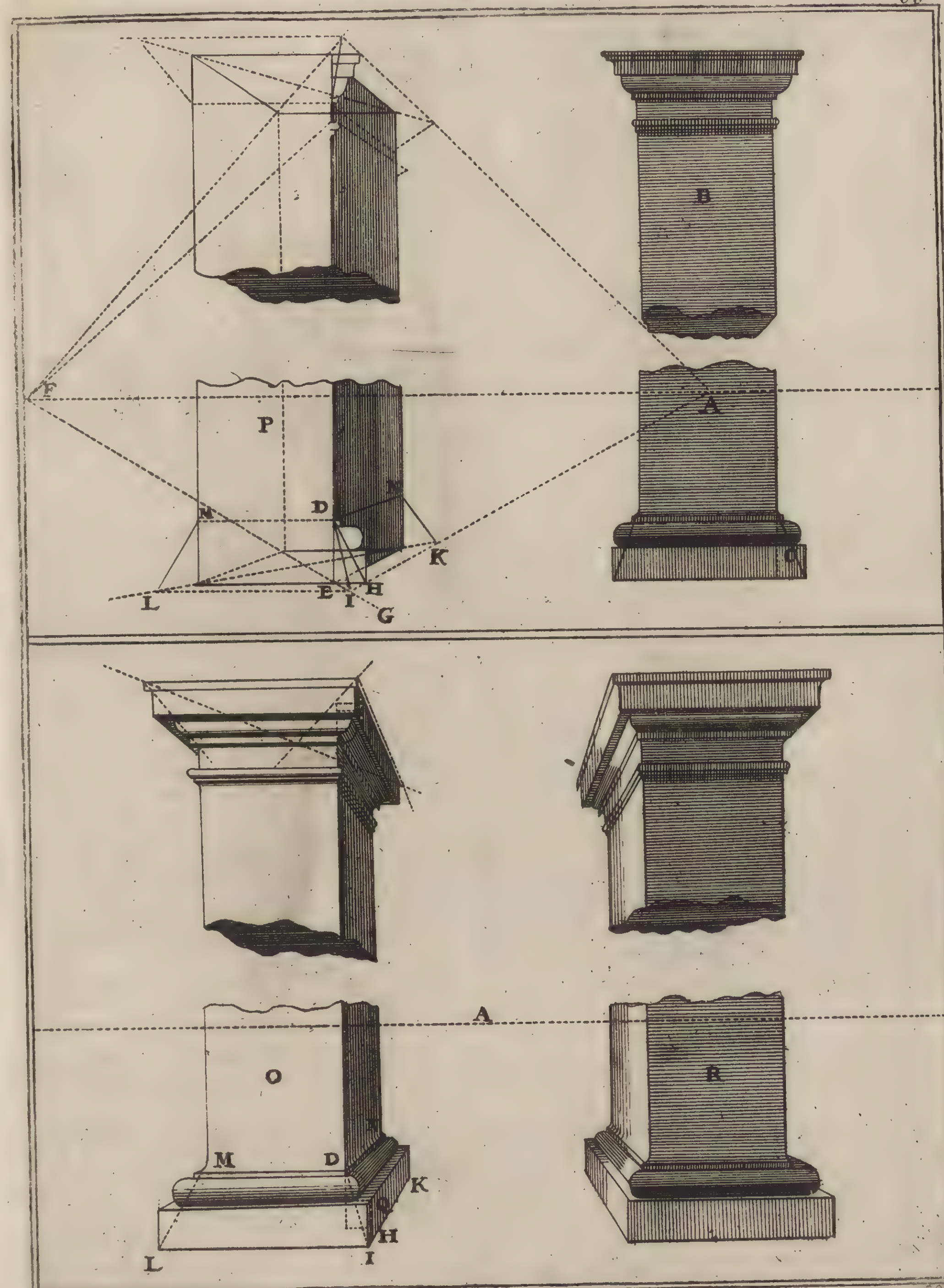
There is ſcarce any building but has ſome moulding or projecture by way of enrichment, and to render it pleaſing to the eye: for this reaſon, it is proper to give the rules for theſe; not the rules for their conſtruction, nor their meaſures and proportions, for in that caſe I ſhould be obliged to give all the orders of architecture, and a thouſand other inſtances; which the reader will find elſewhere: but rules to put them in perſpective, when any particular ornament or order is pitched upon.

To put the pilaſter A B, with its ornaments or members in perſpective: its breadth being taken, and a ſquare plan made as uſual, erect perpendiculars from all the angles thereof, and you will have the body, or ſhaft, of the pilaſter.

Proceed now to take the projectures, or jettings, as for example, the baſe of the pilaſter C, and lay down the ſeveral meaſures thereof in D E. To put this in perſpective all round the pilaſter, from the point of diſtance F draw a diagonal to the point E, and farther at random, as to G; then from the point of ſight A draw a line to the bottom of the projecture H, and in the point I, where this cuts the diagonal, will be the jet, or projecture, of the whole baſe. The ſame line A H gives the projecture of the bottom, by its interſection with the other diagonal in K. For the projecture of the front, from the point I draw a parallel to the baſe line, till it cuts the diagonal in L: this gives the other corner of the projecture of the front. Then drawing lines from the top of the baſe to theſe points, as from M to L, and from N to K, you will have the breadth and height of the whole baſe. The ſame method ſerves for the capital.

The figures underneath ſhew the reſt, and even the effect of what is ſaid, free of confuſion. For the pilaſter O, regard muſt be had to that above in P, where the line D H has upon it all the interſections of the baſe. For this reaſon lines are to be drawn from the point of ſight A, which paſſing through the diviſions of D H, will expreſs the ſame on the lines D I and N K; then parallels being drawn from the points D I to M L, nothing remains but to draw the out-lines. When there happens ſquares, or fillets, either at top or bottom, they are formed by perpendiculars. Thus, for the plinth, perpendiculars muſt be raiſed from the points L I K, and from the point of ſight A a line to be drawn through the angle of the plinth to Q; this will give the height of the perpendiculars I and K. Laſtly, L is to be made equal to I.

This inſtruction for the baſe will ſuffice for the capitals; the operation being the ſame in both. The laſt pilaſter R, is only meant to ſhew one clear of lines. They are all broke in the middle, that there might be room to expreſs both the baſe and the capital; the page not allowing them to be repreſented whole.


B
F
P
A
D
N
K
L
E
I
H
G
O
R
M

To exhibit a large CORNICE *above the* Horizon, in *Perſpective.*

THE method is the ſame as that juſt delivered; but being ſomewhat troubleſome by reaſon of the number of lines, I have judged proper to repeat it again here, in order to avoid confuſion.

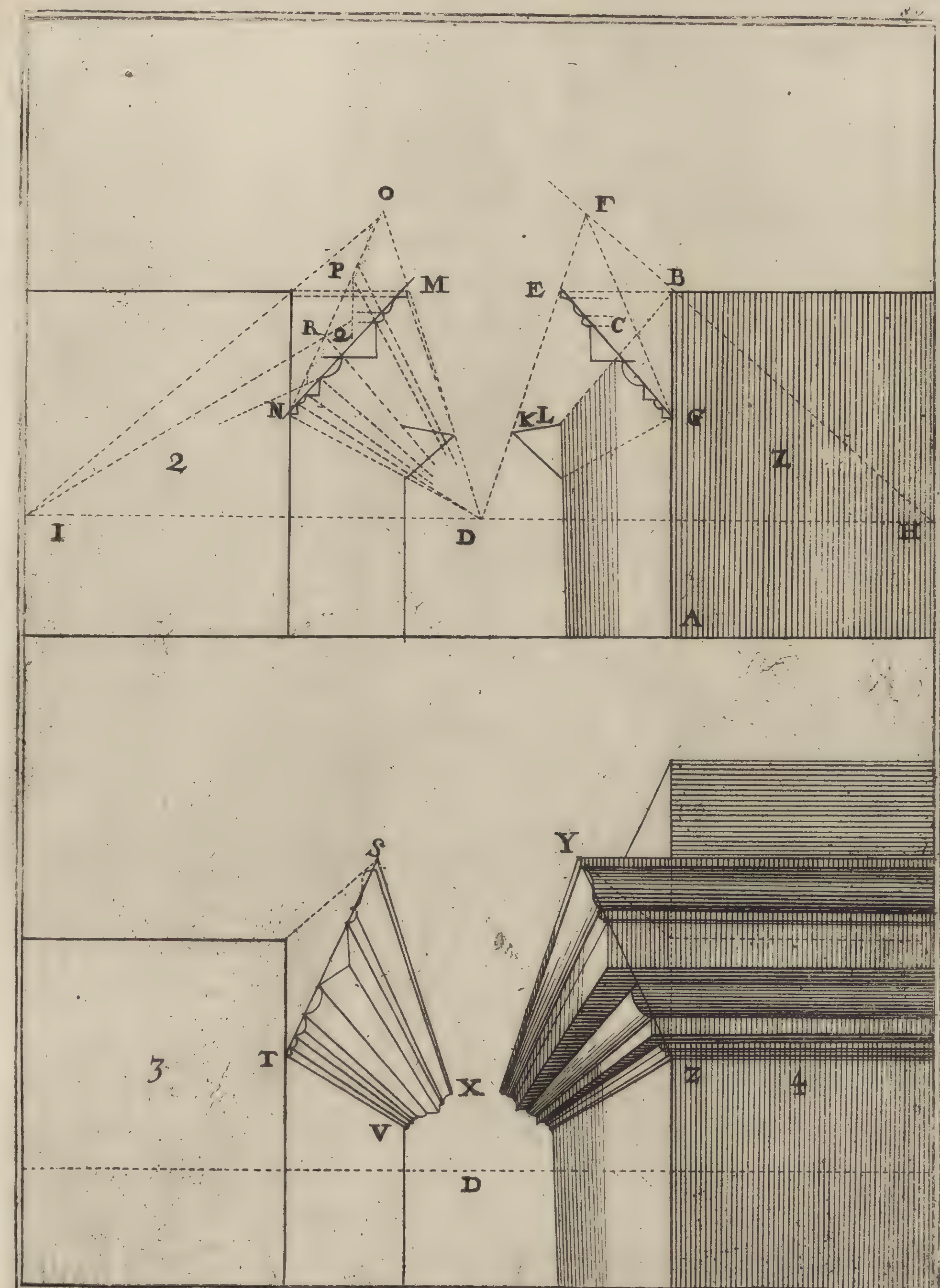
To the purpoſe then: having taken the profile of the cornice, and its projecture, you are to transfer it to the place where the draught is to be made; as here the profile C, *&c.* is at the corner of a wall A B. To find what height it muſt have, and to make it ſhew its bottom, from the point of ſight D draw a line through the extreme of the profile E, as the line D F; then draw a diagonal from the point of diſtance H, paſſing through the corner of the wall B, and prolonged till it cut the ray D E in the point F; from which draw the line F G, which is to repreſent the angle in perſpective, and to receive all the meaſures of E G. The corner of the other end of the wall, K L, is to be drawn to the point of diſtance I, as being the other diagonal.

In *Fig.* II. it is ſhewn, that all the figures which are on the line M N, are to be transferred, by means of viſual rays drawn from the point of ſight D, upon the line N O; in order for parallels to be drawn through all thoſe points, which are to give the cornice complete. But before we go farther, it is to be obſerved, as has been already hinted, that all plat-bands and ſquares are formed by perpendiculars. Thus, for inſtance, to form the large ſquare of the cornice, having made the doucine, and the fillet; from the bottom of the fillet, which is the top of the ſquare, let fall the perpendicular P Q: then, to find the place it is to be cut in, to ſhew the bottom, a line muſt be drawn from the point of diſtance I, through the point at top of the quarter round R, to the perpendicular P Q; and you will have your deſire. What has been ſaid of the large ſquare, holds equally of the leſſer ones; as the denticles, fillets, *&c.* which are all to ſhew their bottoms.

The third *figure* ſhews, that having found all the points, and drawn lines on the line of the angle S T proportional mouldings muſt be drawn thereon. I mean, that when they project much, as is here the caſe, by reaſon the point of diſtance is near, the mouldings muſt be helped out a little; that is, the quarter round muſt be inclined a little, the doucine be erected, the fillets enlarged; and the ſame done at one end as the other; for example, the ſame on V X as on S T.

This done, all that remains is, to draw parallels to the baſe line to form the front-ſide of the cornice.

The fourth *figure* is the cornice complete. In this we have drawn parallels from all the points of the line of the angle Y Z; and one end of the wall is made to paſs over the cornice, to ſhew that we are at liberty in ſuch matters; and that the rule is general.


O
F
P
M
E
B
R
Q
C
N
KL
G
2
Z
I
D
H
A
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Y
T
3
X
Z
4
V
D

To find the Bottoms *of large* Projectures.

TO find the projecture of the corona of the wall A; on the angle of the quarter round B, make a line equal to the length of the intended projecture, as B C; then from the point of ſight D, draw a ray E, paſſing to the extreme of the meaſure C. This done, draw a diagonal from the point of diſtance F, paſſing through the quarter round B; and the point G, wherein it interſects the ray D E, will give the bottom on both ſides, B H: as is more clearly expreſſed in the oppoſite figure K.

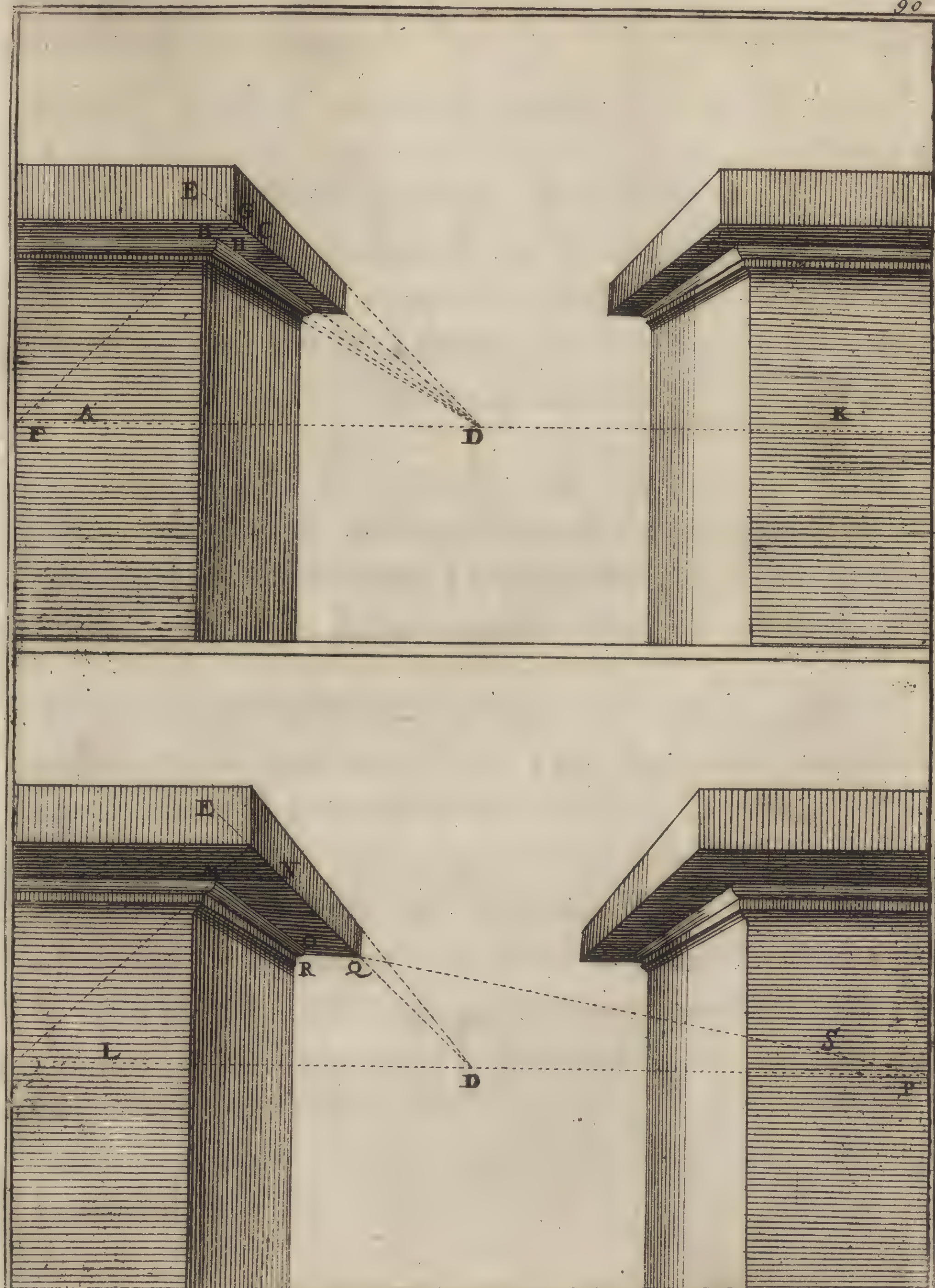
The projecture of the wall L, is formed after the ſame manner as that of the former A. All the difference is, the projecture M N of the wall L, is half as big again as that of B C; to intimate, that the ſame rule makes them as big, or as little as one pleaſes.

It is likewiſe obſervable in the ſame wall, how the return of the projecture, &c. is found. For inſtance, from the point O of the quarter round in the fund of the wall, a diagonal is drawn to the point of diſtance P; and the interſection of that line with the ray C D will be a point, through which a little parallel to the horizon R Q being drawn, will give the return required.

The ſame method may ſerve for all ſquares on cornices and mouldings both great and ſmall.

The wall S ſhews all the mouldings on that of L, more diſtinctly.

90



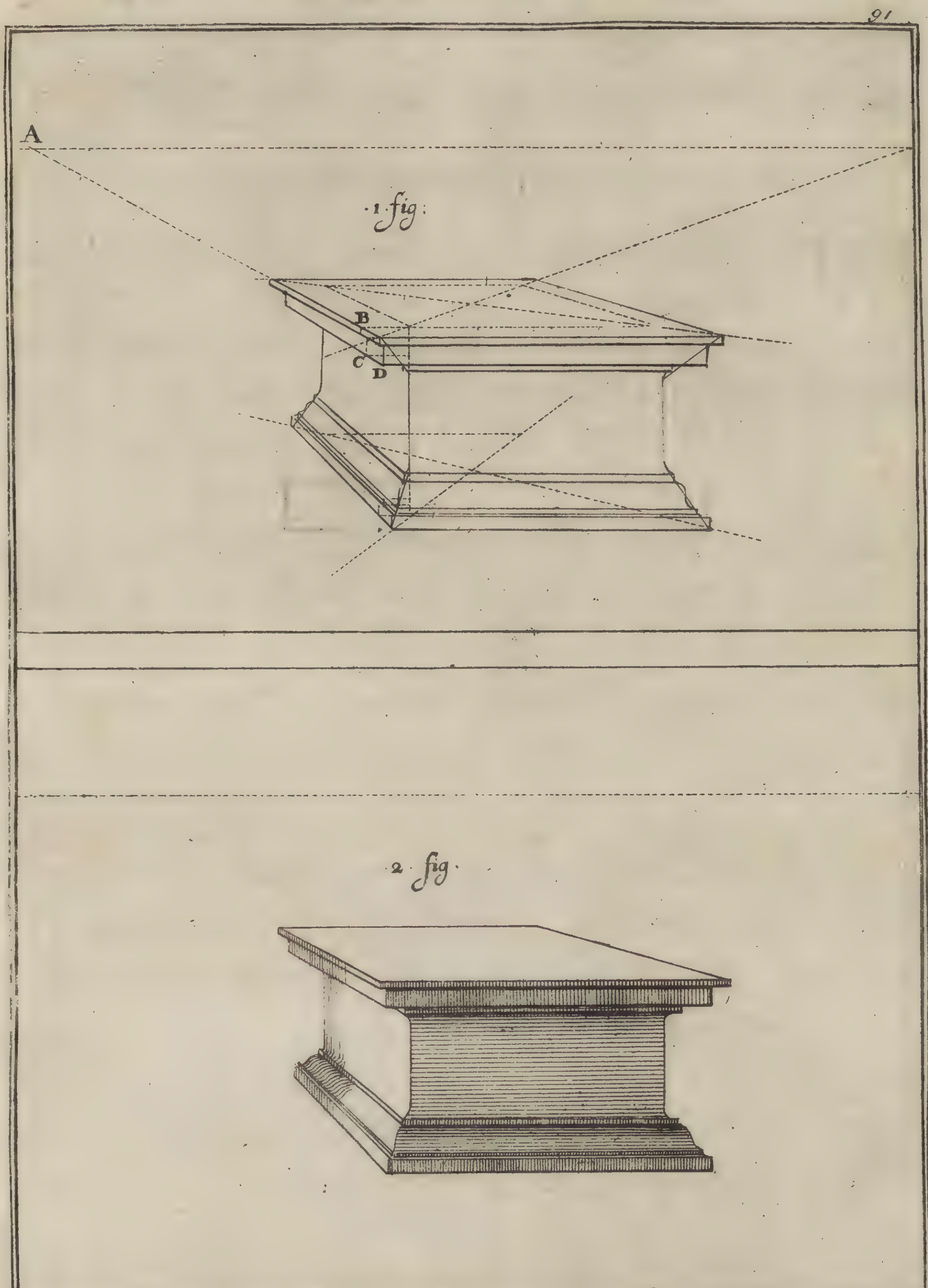
90

To exhibit Cornices *and* Mouldings *below the Horizon.*

THE rules that obtain here are the ſame with thoſe of the preceding caſes; though through an accident which ſometimes falls out, namely, a diverſity of horizons, there ariſes a little variation, which ſuch as are unacquainted therewith might chance to be puzzled withal.

I obſerve then that in viewing a cornice below the eye, and of conſequence below the horizon, the projectures hide ſometimes half, ſometimes more; more or leſs of them being ſeen, according as the eye is more or leſs elevated.

To find preciſely how much of the projection is to be covered, and how much not; ſet the profile of the moulding on the corner of the body to be enriched therewith; and having found the line of the angle, after the manner already directed, draw the diviſions of the profile upon the ſame. Thus will you find that the ſquare, or plat-band, covers the whole aſtragal underneath, and only lets half the fillet be ſeen. For, drawing a line from the point of ſight A, through the profile B C, it cuts the perpendicular from the line of angle in D, and ſhews how much is to be covered. For the moulding at bottom the ſame method ſerves as for that at top.

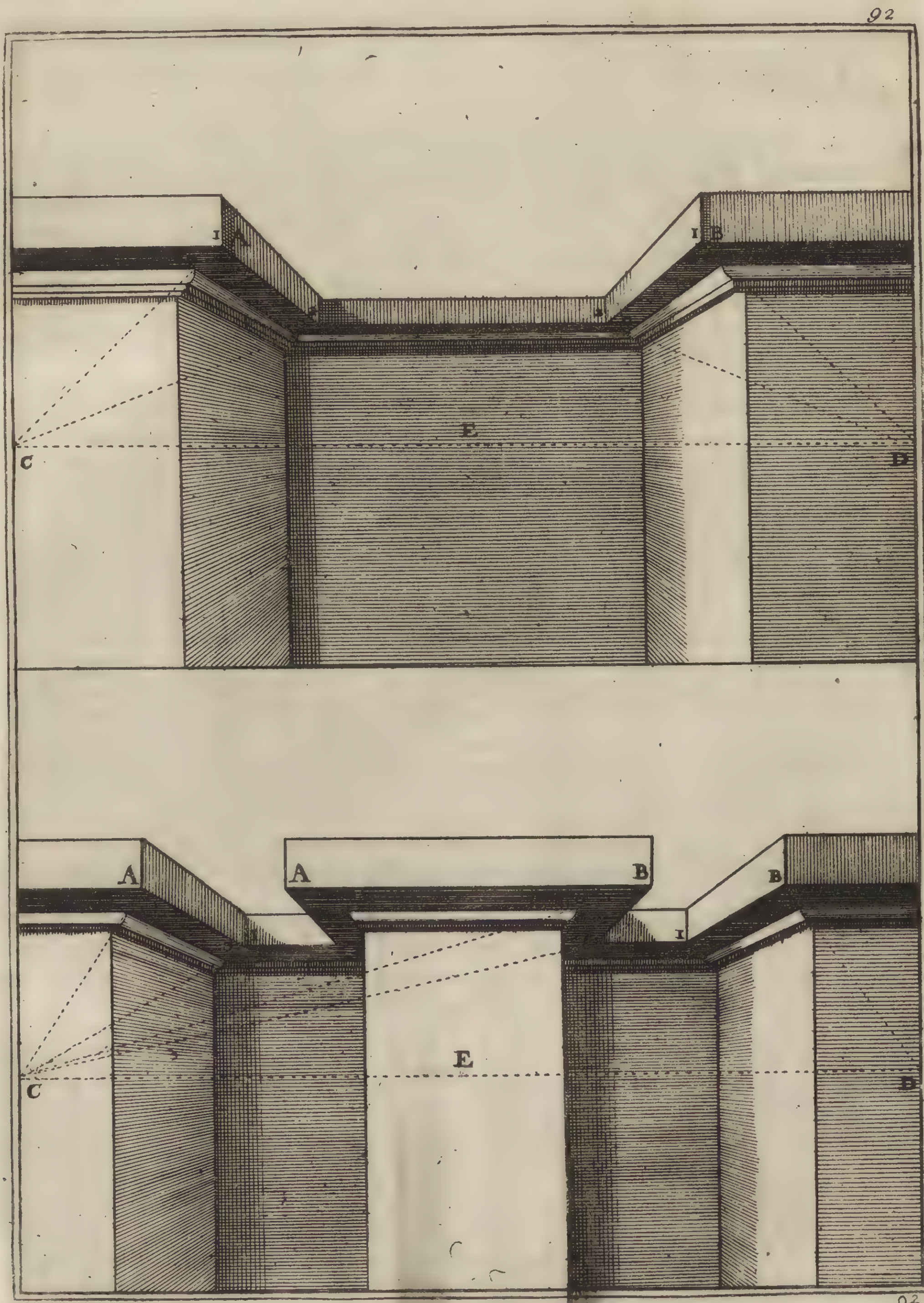

91
A
1 fig:
B
C
D
2 fig
91

To exhibit CORNICES *with ſeveral* Returns.

WHEN there happen divers turns and returns in the cornices or mouldings, their bottoms muſt always be taken from the point of diſtance. Thus, having drawn rays, A and B, to the point of ſight E; from the point of diſtance C, or D, a diagonal muſt be drawn through the angle of the quarter round O, till it cut the ray A or B in I. From which point, I, a parallel to the baſe being drawn, gives the bottom or projecture of the ſquare; as already ſhewn in page 90.

I would willingly have made a much bigger cornice; as that would not have been a whit the more difficult: but the compaſs of the page obliged me to be contented with this.

If you would have returns on the ground, in the manner as theſe are above the horizon; the ſame method is to be obſerved. For proof of this, invert the paper, and you will find it have the ſame effect.


92
A
I
I
B
E
C
D
A
A
B
B
I
E
C
D
92

To exhibit the APERTURES *of* Doors *in Perſpective,*

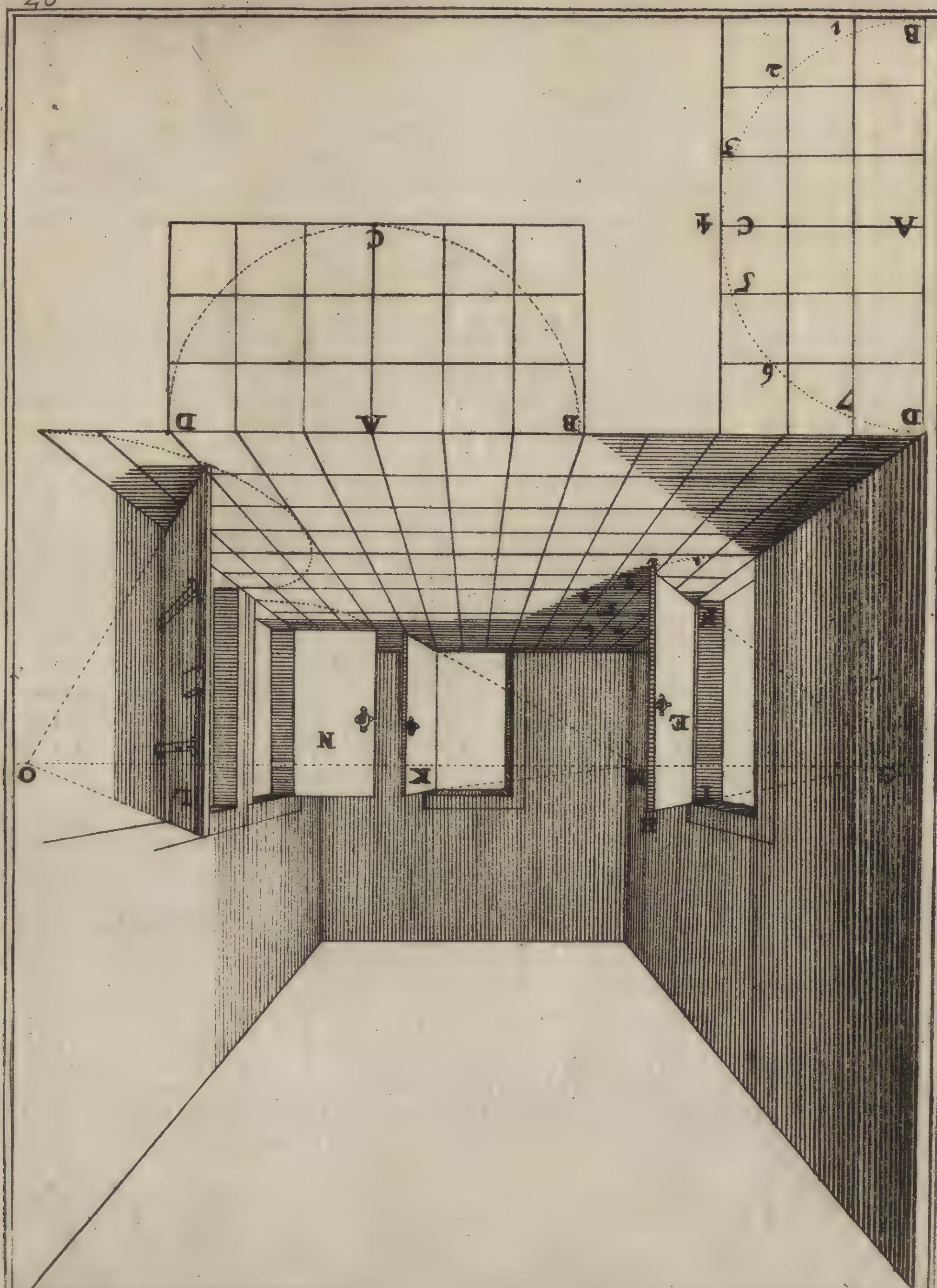
IN my inſtructions, I have kept pretty cloſe to the order obſerved in the actual erecting of buildings of all kinds. I now proceed to ſhew how to furniſh and diſpoſe them for the reception of inhabitants. I begin with wooden doors; and hereafter ſhall find occaſion to ſpeak of other apertures, as windows, cupboards, *&c.* then of moveables, as tables, beds, chairs, cheſts, benches, *&c.*

All doors are to open and ſhut far or little at the pleaſure of the perſon who opens them. For this reaſon I ſhall ſhew an eaſy method of putting them in perſpective, at any degree of width or aperture at diſcretion.

Now it is obſervable, that doors, windows, cabinets, cheſts, and, in fine, every thing intended to open and ſhut, always deſcribe a ſemi-circle in opening. The reaſon is, that the ſide hung by hinges keeps its place, like the fixed leg of a pair of compaſſes, while the other ſide, like the other leg of the compaſſes, ſweeps its arch. Thus in the plan underneath the oppoſite figure, the fixed ſide A extending to B, if you open the door quite, the ſide B muſt deſcribe the ſemi circle B C D, whoſe center is A. Hence it follows, that if the door be three feet broad, as in the preſent caſe, the radius A C will likewiſe be three feet, and the whole chord or diameter of the ſemi-circle B A D ſix feet. Of theſe ſix feet in length, and three in breadth, a plan muſt be made, conſiſting of eighteen ſquares, wherein the ſemi-circle A B C D is to be deſcribed, this method is directed to render the making of the ſame ſemi-circles in perſpective the more eaſy. Always obſerving where the ſemi circle of the plan cuts the ſquares, that thoſe in the perſpective may be cut after the ſame manner, and a ſemi-circle be drawn, taking up the ſame ſpace, traverſing as many ſquares, and cutting them in the ſame places. An inſtance of which you have in the door E, where the interſections are marked the ſame as in the plan underneath, 1, 2, 3, 4, 5, 6, 7.

When a door is to be repreſented open in perſpective, a ſemi-circle muſt be ſtruck on its plan, and the point of aperture placed on any part thereof at pleaſure. Thus for the door E the point of aperture is fixed at 2. From this point 2 a perpendicular muſt be raiſed, as 2 H; and from the ſame point 2, a line muſt be drawn through the corner of the door F, and continued till it cut the horizon in the point G; from which another line muſt be drawn through the other corner of the door I, and continued till it cut the perpendicular raiſed from the point 2, in the point H. Thus will you have the door open F I H 2.

All apertures are performed by the ſame rules as is farther ſeen in the doors K and L. The door K ſhews its outſide, and that of L its inſide; yet both are performed after the ſame manner as the firſt. The accidental point of K is drawn from the point M in the horizon, and that of the door L from the point of diſtance O. If bolts, locks, or the like, be added on the doors, they muſt all be drawn from the ſame accidental point; as the bolts and lock of L tend towards O. What accidental points are, has been explained, page 12. Now all apertures have one ſuch point in the horizon, excepting two ſorts. The firſt, when the door is quite open; in which caſe its accidental point is the point of ſight. The other, when its poſition is parallel to the horizon; by reaſon the parallels, in that caſe, never interſect: as in the door N.



To exhibit Apertures *of* Cafements *in Perfpective.*

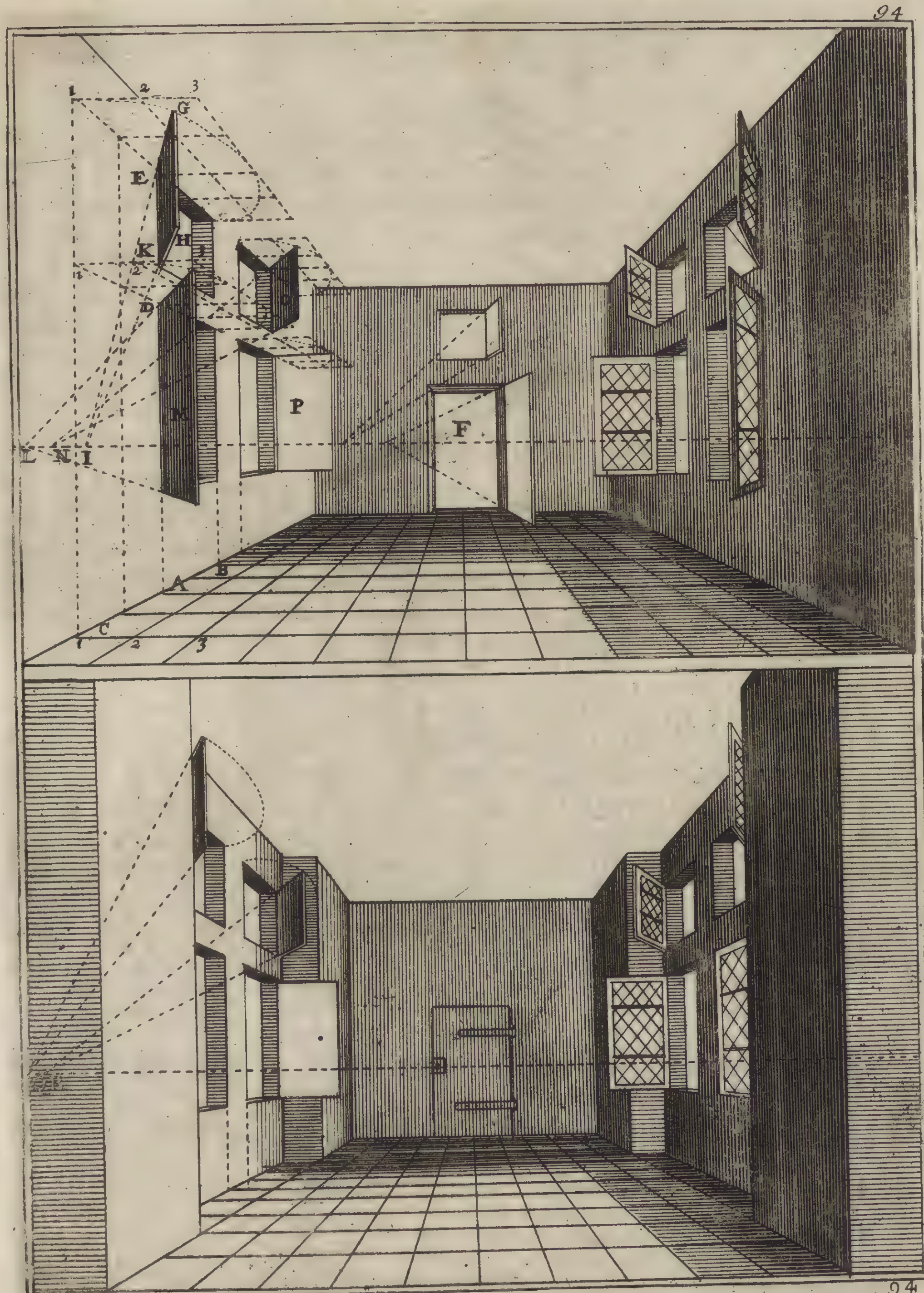
ALL the difference between the *apertures of cafements*, and thofe of *doors*, lies in this, that doors have their femi-circle of aperture on the plan, and cafements in the air; by reafon windows are raifed, and doors ufually turn on the ground. On this account, the femi circles of cafements may be either over or underneath them. And in fuch femi-circles is the point of aperture to be placed.

Thus, for inftance, if a cafement be two fquares, or panes, broad, as A B, and it be made quite open, it will then take up two fquares more C A, whereof A is the middle, and the center of the femi circle A B C. But by reafon the window is raifed above the ground, the femi-circle muft alfo be raifed; as is here actually done in the femi-circles of the windows D and E: whereof the fame D and E are the centers; and which are eafily formed by erecting perpendiculars from the intermediate fquares, till fuch time as they interfect the rays drawn from the corners of the cafements D, E. From thefe interfections, lines muft be drawn to the bafe line, and the meafures of the fquares of the plan 1, 2, 3, be fet thereon. From the fame points 1, 2, 3, lines are to be drawn to the point of fight F; which cutting the parallels, will give fquares to fix the aperture by. Proceed then to take the apertures after the fame manner as thofe of doors. For example, the point G being given in the upper femi-circle, from the fame G draw two lines; the one, G H, perpendicular; the other paffing through the corner of the window E, and cutting the horizon in fome point, for example, the point I. From this I, draw a line through the corner of the window K, till it cut the perpendicular in the point H, which gives the cafement open K E G H. The fame is to be obferved with regard to all the reft; and the point ftill to be taken in the horizon. Thus, L is the point for the cafement M; and N, that for the cafement O. The cafement P has none at all, as being parallel to the horizon.

The cafements on the other fide are performed after the fame method, without any of the confufion of lines. Both the one and the other range with the wall, to facilitate the operation. The door at bottom is done after the manner already directed; and the cafements according to the method laft delivered.

Apertures *of* Cafements *with* Embrafures.

THE rules for thefe are the fame as for thofe that range even with the wall, excepting that thefe are not capable of being quite opened, by reafon of the thicknefs of the chamfraining, or embrafure. On this account we never give them a whole femi-circle, but a portion anfwerable to the aperture they admit of. The accidental point fhould always be in the horizon, for upper windows, as here in Q and R; that below is parallel to the horizon.


94
1
2
3
G
E
K
H
D
P
F
M
L N I
A
B
C
94

Divers other APERTURES.

THE *openings of cupboards, presses and chests*, are at least as necessary as those of doors and windows; nor had the omission of the one been a whit more excusable than that of the other. Their doctrine will be dispatched in two figures.

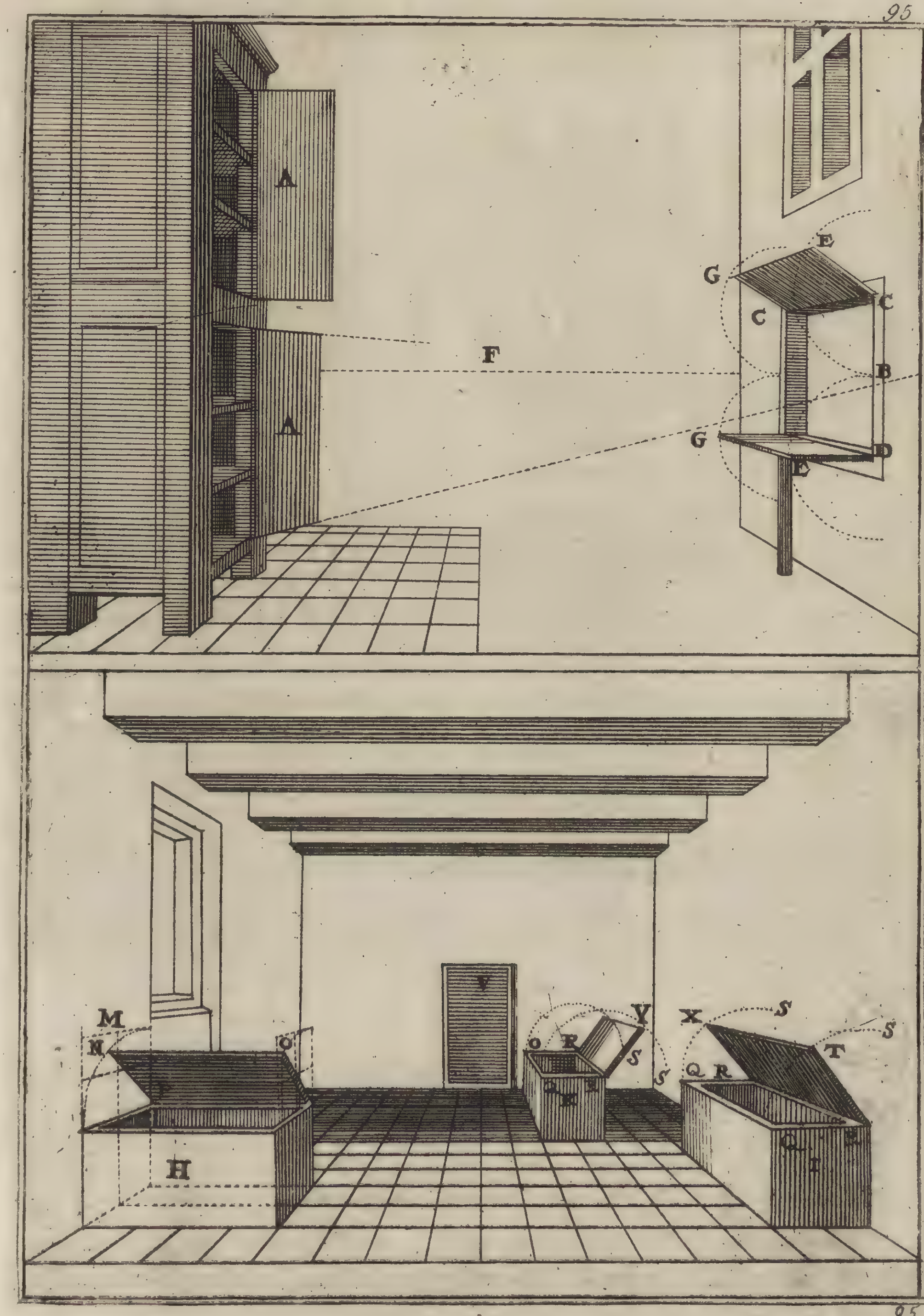
The cupboards or presses A A, are opened according to the rules delivered for casements, which it would be needless here to repeat. I shall only add, that the uppermost is parallel to the horizon; and that the latter tends to the point of distance B.

The *shop* on the other side is opened by two leaves, one of them rising upwards, and the other falling downwards. Each of them describes its semi-circle from the centers C and D; which being drawn with the compasses, the apertures are fixed at any point at pleasure; as here in the point E; from which a ray is drawn to the point of sight F, till it intersect the semi-circles at the other ends in the points G. From these points E and G, lines being drawn to the centers C D, give the leaves opened in that position.

In the lower figure there are three *chests*, differently opened. To open the first, H, the quadrant M is put in perspective, according to the measures of the squares of the plan. Thus, observing the width of the chest, which is two squares, perpendiculars are to be raised thence, and a semi-circle, or quadrant, described for the opening, which is here fixed at the point N; and from this a parallel is to be drawn to the other quadrant O; and from N and O lines to be drawn to the centers P P. If a greater aperture is required; a semi-circle is to be drawn in lieu of a quadrant.

The chest I in that position has the easiest of all openings, for having taken the breadth Q R, from the center R describe the semi-circle Q S; then take any aperture at pleasure, as T, and draw a line to the point of sight V, cutting the other semi-circle in X; and, lastly, from the points T and X, draw lines to the corners R, and you have the lid formed with that aperture.

If it is required to open the chests farther, you have only to fix the point of aperture high in the semi-circle; as Y is in the chest K. The rest of the process is the same as in the first chest.


95
A
A
F
G
E
C
C
B
G
D
E
M
N
O
P
H
V
O
R
Y
S
S
Q
X
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S
T
Q
R
Q
I
95

Plans *and first* Elevations *of Moveables.*

THESE plans I ſhould have placed in their order among the reſt, but for this conſideration; that had I treated of them at the beginning of the work, without ſhewing the neceſſity thereof, they would have paſſed for uſeleſs, and accordingly have readily dropt out of remembrance. They now come in ſeaſon, and cannot fail of being well received and learnt with pleaſure; inaſmuch as numerous ſorts of *moveables* or *houſhold goods* have a dependance upon them.

The firſt plan, A, may ſerve for *beds*, *tables*, *chairs*, *ſtools*, &c. The other B, which is twice as long as it is broad, ſerves for *long tables*, *cupboards*, *buffets*, *cheſts*, *trunks*, &c. The third, C, which is long and narrow, ſerves for *benches*, or *forms*, *couches*, and other pieces of furniture with ſix legs or feet.

The acquaintance the reader is ſuppoſed to have with the other plans already treated of, will render the performance of theſe eaſy; there being nothing more required than to lay down their dimenſions on the baſe line, draw lines thence to the point of view, and ſhorten them by means of the points of diſtances.

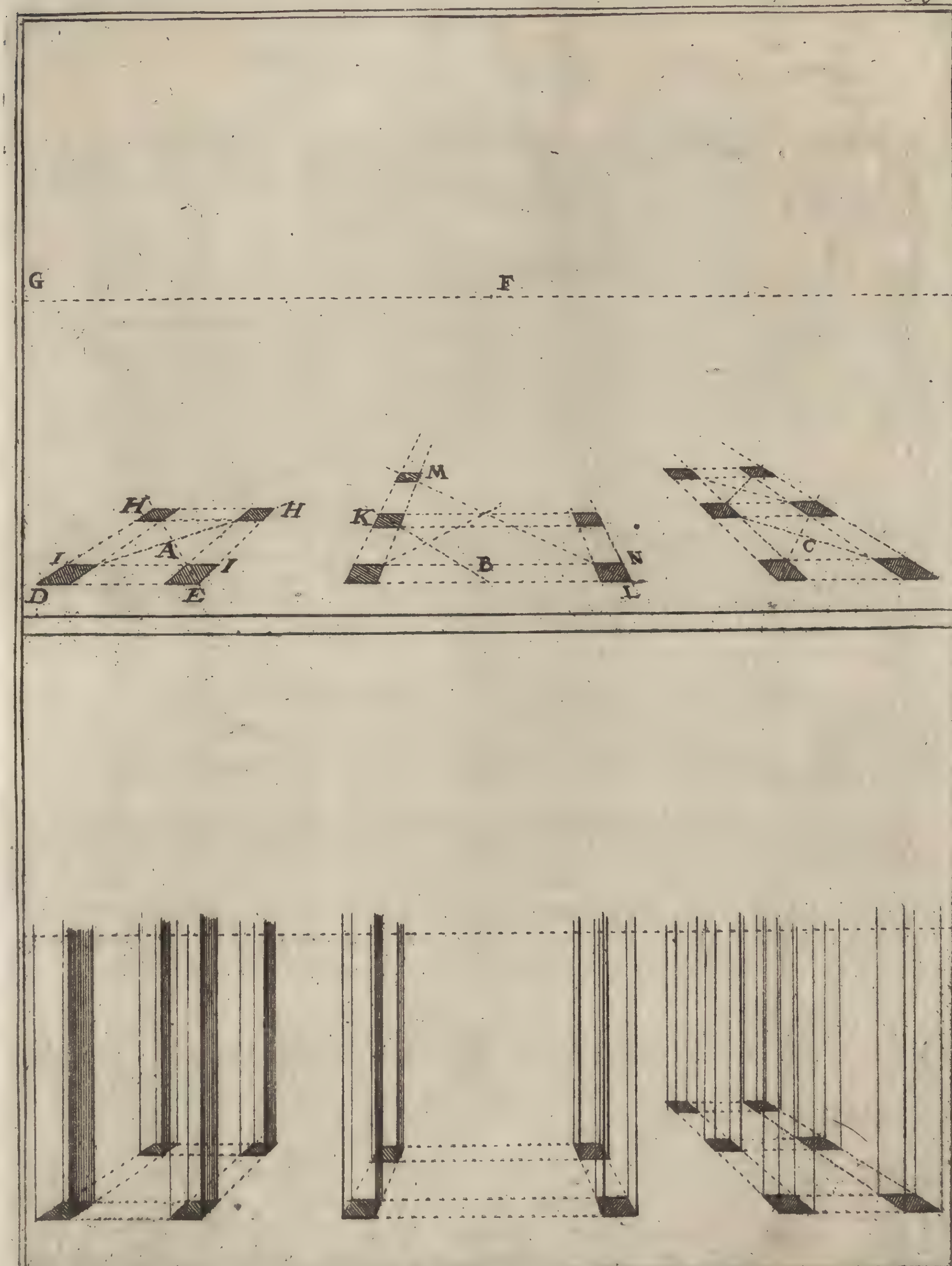
Thus, for example, for the firſt plan A, the two meaſures of E and D muſt be ſet on the baſe, and lines be drawn thence to the point of ſight F. Then from one of the points of diſtance, a line is to be drawn to one of thoſe meaſures, as from G to E; and through the points H and I, wherein it interſects the rays, parallels are to be drawn; by this means four little ſquares will be formed, whoſe meaſure you may account as much or as little as you pleaſe. For a table they muſt be more than for a ſtool, that is they muſt have more breadth; the latter being uſually two inches, and the former four.

The plan B is performed after the ſame manner; excepting that on account of its length, which is double its breadth, a line muſt be drawn from B to one of the points of diſtance, to find the half K. For if a line were drawn from L, it would interſect in M, and give a whole ſquare; whereas we only want half of it. Parallels then muſt be drawn from K to the points of interſection with the ray; and from the corner L, a line muſt likewiſe be drawn to the point of diſtance G, interſecting the ray: Thus will you have the four little ſquares.

The third plan, C, needs no explanation; it being evident that it is formed like the firſt A; and that the ſquares muſt be doubled to get the ſix little ſquares.

The figures underneath are intended to ſhew that perpendiculars muſt be raiſed from all the angles of the aforeſaid ſquares, to begin to form the moveable pieces of furniture hereafter ſhewn.

96



96

Elevations *of* Moveables.

HAVING raiſed perpendiculars from the plan, as already intimated; a line of elevation muſt be made in ſome part of the painting, on which the heights, croſs pieces, *&c.* are to be laid.

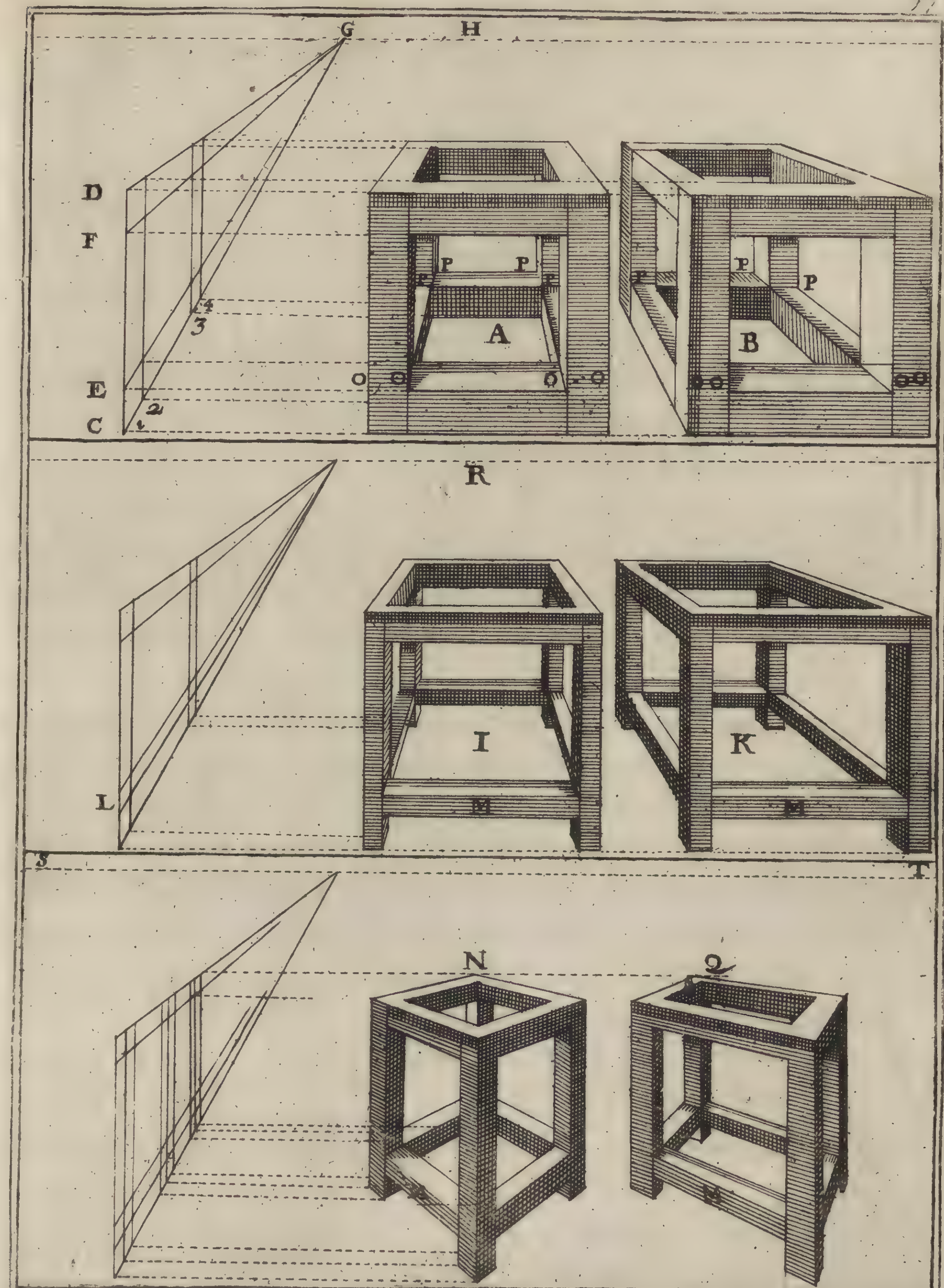
Thus the line C D being a line of elevation, and C E and D F breadths or depths of the croſs pieces; from theſe four points draw lines to ſome place in the horizon, as to the point G. Then having erected perpendiculars from all the angles of the plan, as in A and B; from the angles draw parallels to the baſe line, till they cut the line C G. Thus will you have the points 1, 2, 3, 4; from which perpendiculars are to be raiſed, and the interſections thoſe perpendiculars make with the line D G, will be the points to cut the perpendiculars of the plans, as ſhewn in the figure; where a parallel being drawn from the point E, cuts the firſt perpendiculars of the plans A B in the points O; from which drawing lines to the point of ſight H, the other perpendiculars of the plans will be cut in the points P P, *&c.* And doing the like from the point F, *&c.* you will at length have a cube perforated on all its ſides. Which proceſs being well underſtood, all the other pieces that follow, and even all that can be conceived, will be readily performed.

Inſtead of parallels from the points on the line D G, to cut the perpendiculars of the plan, the meaſures of them taken with the compaſſes and transferred to thoſe perpendiculars will anſwer the ſame purpoſe, as has been ſhewn elſewhere.

It is eaſily obſerved, that the two frames or ſtands of tables, I and K, are performed by the ſame rule as thoſe above. All the difference is in the croſs-bar at bottom, which is higher in the line of elevation in this latter caſe, than in the former. In the latter, for inſtance, we find it in the line L, which gives M M. The feet of the ſtands or that part of the perpendiculars which are beneath the croſs bars, one may either leave them ſquare, or round them into bowls.

As to the laſt frames, N and Q, there is nothing in them more than in I and K; only that they are viewed by the angle, and the other in front. The plans of thoſe ſtands, I and K, are drawn to the point of ſight R; and theſe latter to the points of diſtance S T.

The figures in this plate, with little variation, may be adapted to divers ſorts of moveables. Thus, for inſtance, to make a bedſtead of *Fig.* I or K, nothing more is required than to give it a proper height and breadth. In every thing elſe the operation is the ſame as for a couch, a ſtool, or the like. For a table you have only a top to add. For a joint-ſtool, beſide the top, it muſt be made more in height than width, but the conſtruction thereof with four legs, and the four croſs bars, is the ſame as in this figure.


G
H
D
F
P
P
P
P
P
P
4
3
A
B
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O
O
O
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2
C
1
R
I
K
L
M
M
S
T
N
Q
M

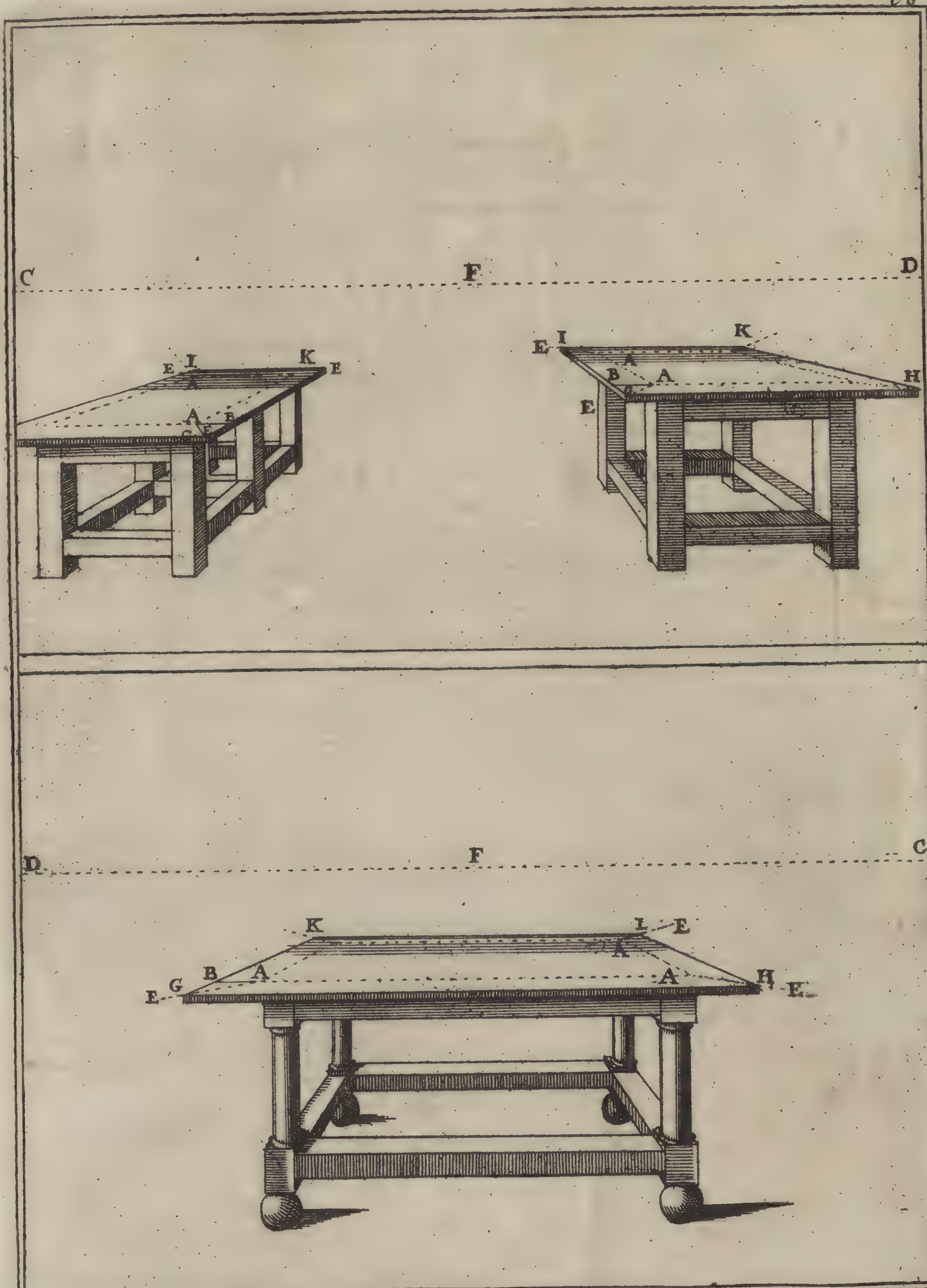
To exhibit the upper Part of Tables, Stools, *&c.*

HAVING raiſed perpendiculars from the plan, as directed in the foregoing page, and fixed the proper height thereon, the frame will be complete. Now to make a cover to it perfectly on a level, and which ſhall not extend beyond the frame, there needs nothing more than to leave the top of the cube plain, without expreſſing any other lines but thoſe which bound the four ſides, which will make the upper part of a table, ſtool, or the like.

But if it is deſired the upper part or cover ſhall have a projecture, or ledge; from one of the angles of the frame a parallel muſt be drawn, as A B; and on this parallel the meaſure or quantity of the intended projecture muſt be ſet, as here AB. Then from the points of diſtance C and D, occult lines AE, AE, *&c.* muſt be drawn through the angles of the ſquare of the frame here expreſſed by dotted lines. And to make the meaſure A B give the proper breadth to all the ſides and angles of the table; draw a line from the point of ſight F, through the point B, continuing it till it cut the line CAE in the point G. From the point G draw another parallel, cutting the other occult line in H. Then drawing lines from the points G and H to the point of ſight F, the other diagonals will be interſected in I and K; which will give the upper part of the table, with the projecture that was ſet on the line A B.

The thickneſs of this upper part of the table is fixed at pleaſure.

This ſame method may ſerve for the upper parts of any objects, whether in front or in ſide-views below the horizon, and for the bottom of thoſe that are above the horizon, as particularly ſhewn in pages 49 and 50.


C
F
D
E I K E
A
A B
E I K
A
B A H
E
D
F
C
K
L E
A
E G B A A H E

To exhibit the Elevation of Buffets, Preſſes, *and* Cup-boards.

HAVING made the plan, and raiſed perpendiculars from all the angles, as already taught; upon the line A B, which is here to ſerve for a line of elevation, the meaſures or proportions of the diſtances of the ſhelves, with their thickneſſes, *&c.* as here C D E, muſt be laid down. Then from the points C D E, draw parallels to the baſe line, as far as the upright poſt G F; and from the points thus marked on G F, draw lines to the point of ſight H; as far as the other poſt I K, forming the breadth of the buffet. This breadth is fixed at pleaſure, by laying down the intended meaſure on the baſe line. Thus for the breadth of the preſent buffet, the diſtance F L is laid down; and from the point L, a line is drawn to the point of diſtance M; and the point I wherein it interſects the ray F H, is the place of the laſt poſt.

The buffet on the oppoſite ſide is performed after the ſame manner. To adjuſt the proportions of the little cabinet, or locker, ſupported by two columns in the middle thereof, take the points L P, which are in the middle of Q N, or of the breadth of the buffet; and drawing lines thence to the point of diſtance O, where the ray N H is interſected thereby, draw parallels to the baſe line, cutting the ray T H in the points V V. And perpendiculars raiſed from thoſe points will give the little cabinet in the middle.

The *large preſſes*, or *cup-boards*, in *Fig.* II. are performed after the ſame manner as the buffets above; only that in the middle being viewed in front, needs a little explanation to determine its depth. I obſerve, then, that its plan muſt be formed, as already directed, and as one half of it is here ſhewn. Then, to make croſs pieces equal to theſe in the front, occult lines muſt be drawn from the firſt upright poſt R, to the firſt perpendicular of the depth S; and from the points of interſection draw little parallels to the baſe. The reſt of the operation is plain.

6

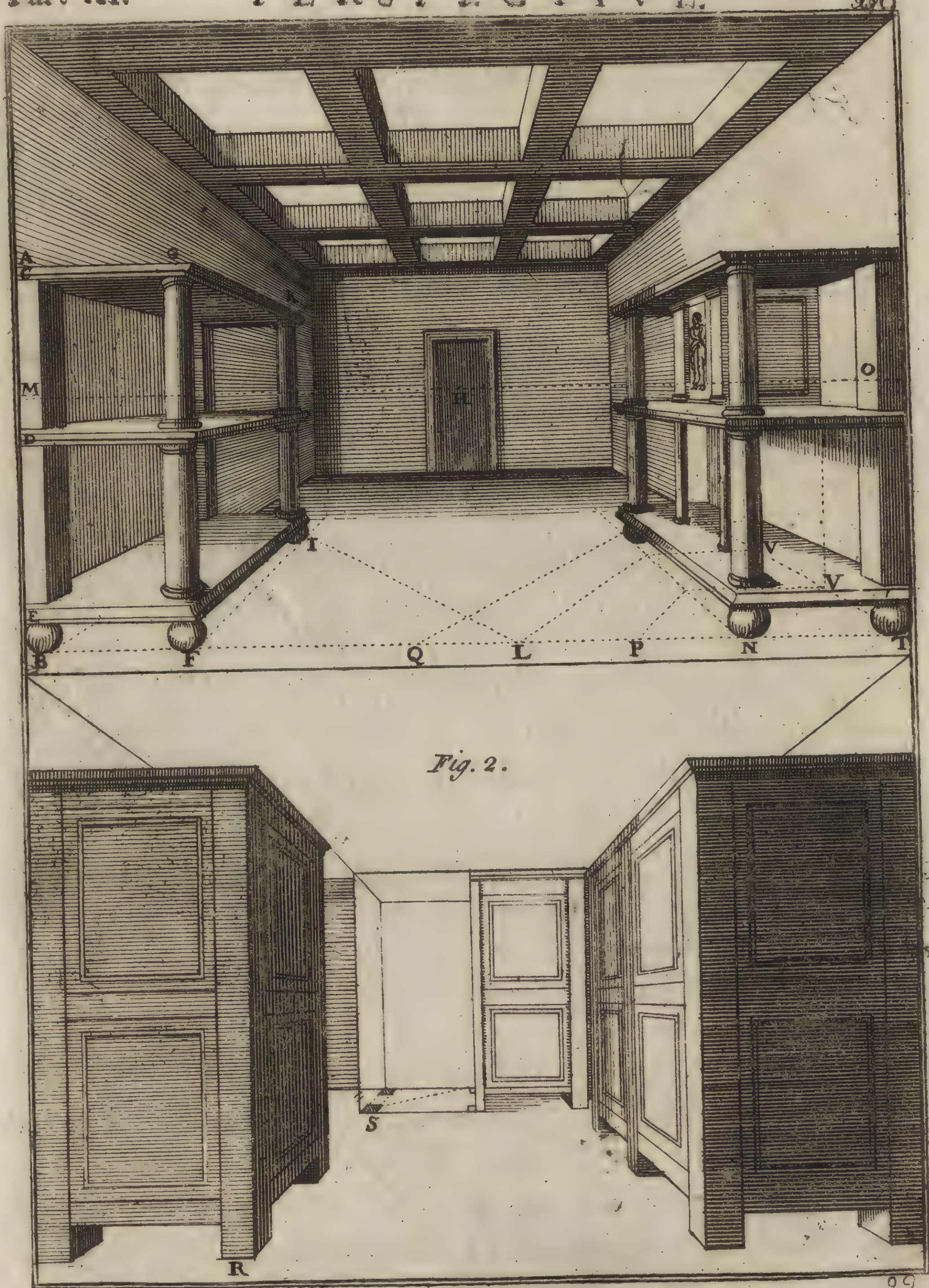


Fig. 2.

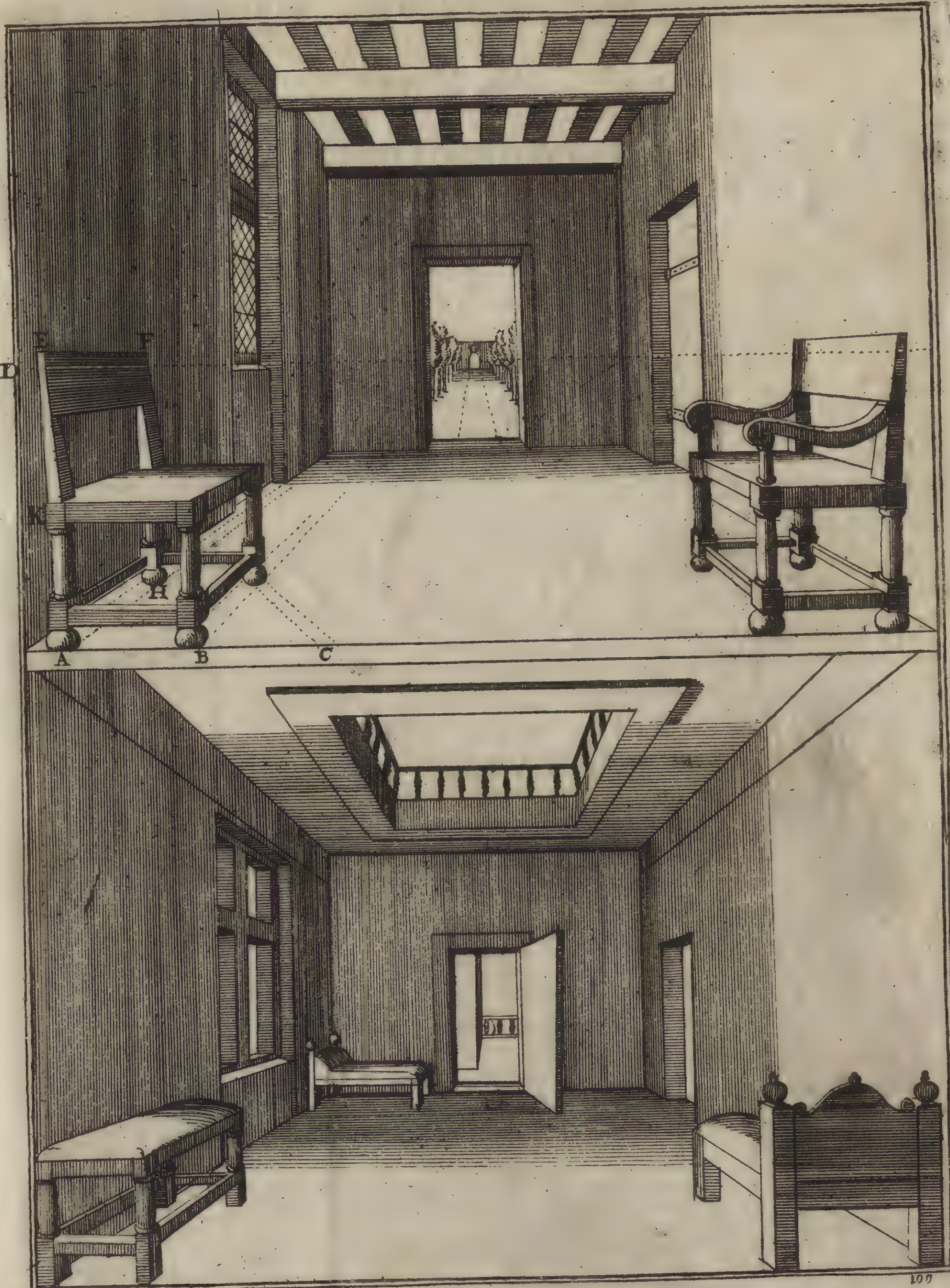
The Elevations *of* Chairs, Forms, *and* Couches.

To *raiſe a chair*; from the dimenſions A B C, erect perpendiculars, and proceed in the ſame method already directed for table-feet, or frames without tops. All that is to be done farther, is to procure the back of the chair; which may be made of any height at pleaſure. In the preſent caſe the height of the back is equal to that from the foot A to the ſeat K. Which proportion may ſerve equally for elbow chairs.

From the figure it appears evident enough, that to form the back there is nothing needed but to prolong the perpendiculars of the legs, as here A E; and from the point E to draw a line to the point of ſight G; which cutting the perpendicular or poſt raiſed from the plan, or the foot H, gives the point F. The reſt the figure makes clear.

If elbows are required, you have only to raiſe the perpendiculars of the front legs higher, as the hind ones are for the back, and to draw a croſs piece, or bar, in the ſhape you would have the elbow.

In the figure underneath, you ſee a form, or bench, covered with cloth, and two couches. The head of one is turned back in the front of the picture, and the other is viewed obliquely. It would be loſs of time to dwell upon the manner of making them; the rules being altogether the ſame as thoſe already laid down for other moveables, mamely, by making a plan, raiſing perpendiculars, &c.


E
F
D
K
H
A
B
C

Another Method of putting Moveables *in Perſpective.*

THERE are ſome *moveables* that *fold,* or ſhut down, and that ſerve for tables, ſeats, beds, *&c.* very eaſy to be put in perſpective.

As to the elevation, it is performed as that of a cube, as ſhewn in A B C D, which is viewed in front; or E F G H. Then two diagonals, A C and B D, are to be made for that in the middle of the front; or E H, and F G for that of the ſide: and theſe will ſerve for the drawing of the two croſſes; taking care that one enter half through the other, as G K does through H I; and both of them to be faſtened by the middle to make them fold.

In the figure underneath we add a table upon treſſels, that even the leaſt conſiderable moveable might not be wanting. To put them in perſpective, from the points A, and B, which are the interval between the feet of the treſſels, draw a line to the point of ſight C; then, laying down the thickneſs of the ſame feet on the baſe line, as here D and E, draw lines from the ſame to the point of diſtance F, and obſerve where they interſect the ray B C; and from the points of interſection draw little parallels to the baſe line; by which you will have the little ſquares or plans of the feet, as in A and B: then between the diſtance D and E, lay down the breadth intended for the top of the treſſel, and drawing a line thence to the point of diſtance F, it will cut the ray B C in the points G and H; from which points, perpendiculars are to be raiſed to any height at pleaſure, as here to I. Laſtly, from the angles of the little ſquares of the plan draw lines to I. The ſecond treſſel is performed after the ſame manner as the firſt.

The *form* K, and the *table*, or *ſeat* L, need not any explanation, to put them in practice, as having nothing but what is common with the pieces above-mentioned.

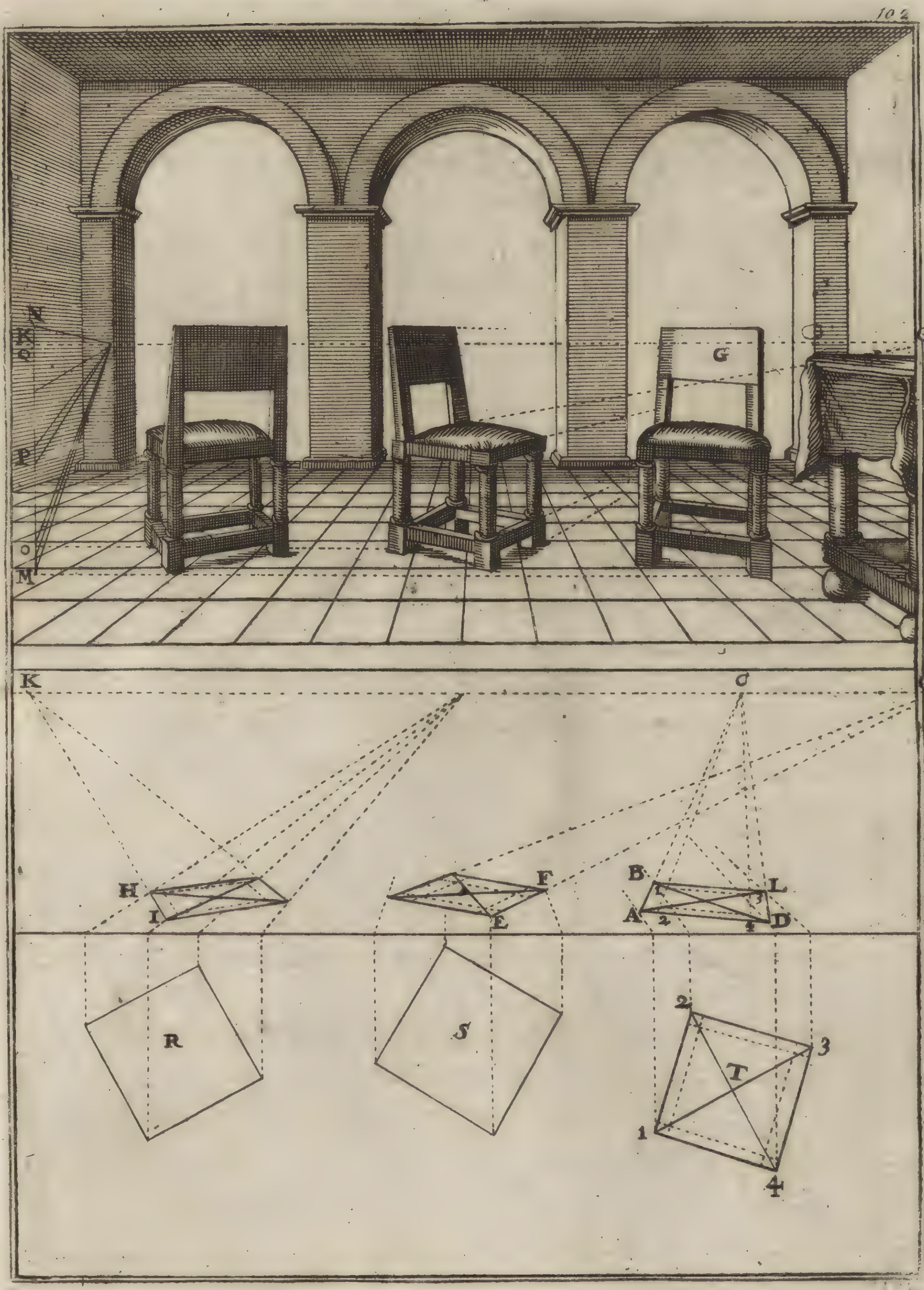
102

To exhibit MOVEABLES *placed without any Order.*

WHEN moveables are placed orderly along the ſide of a wall, or in the direction of the rays and the baſe line, it is eaſy to put them in perſpective by the rules already delivered; but if they be irregularly placed, as in this figure, you are to proceed as I ſhall now direct. Draw the geometrical plans, R, S, and T, for plans of three chairs; which are to be diminiſhed or put in perſpective by the rule delivered for the irregular figure, page 40, and the plans will be found ſituated like the chairs, or rather the chairs like the plans. Now the plans being in perſpective, lay a ruler along one of the ſides, to ſee what accidental point it gives in the horizon; thus, laying a ruler along the ſide A B, you have the point C in the horizon for an accidental point, to which all the lines of that and the oppoſite ſide muſt be drawn. In this manner you ſee that A and D are drawn to the ſame point C. It is true each plan placed irregularly ſhould have two accidental points, but they are frequently ſo far off in the horizon, that it is doubtful whether you find them both. The preſent plans have each of them one; as A B has C; and A D, the other ſide, would have another, if our paper were broad enough. E F gives G for its accidental point, and I H gives K. As to the little ſquares 1, 2, 3, 4, they are the plans of the feet of the ſame chairs, as may be made broader and narrower at pleaſure.

Proceed then to erect perpendiculars from all the angles of the plan, and on the ſide of the picture add a line of elevation M N, whereon to lay the dimenſions of the croſs pieces; as O, for the lower bars; P for the bars of the ſeat; and Q for the backs of the chairs. Things thus diſpoſed, from the angles of the plan draw parallels to the baſe line, as far as the line of elevation, and in the points of interſection erect perpendiculars. Theſe will give the dimenſions, as already obſerved of the former figures.

All the lines of the ſides are to be drawn to the accidental point of the plan. Thus, in the middle chair, all the ſides are drawn to the point G, which is the point of the plan, as appears from the figure.


102
N
K
Q
P
O
M
G
G
K
C
G
H
I
F
E
B
A
L
D
1
2
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R
S
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4

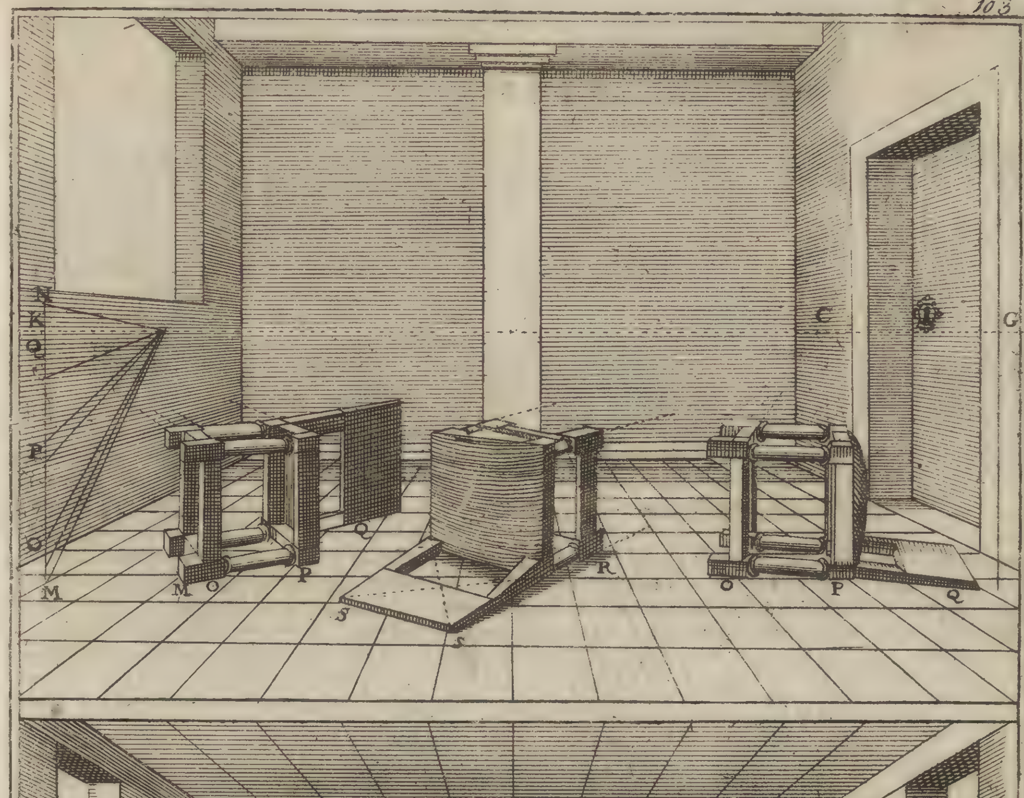
To exhibit MOVEABLES *laid or tumbled on the Ground.*

FROM the ſame plan, which has been given for chairs ſtanding on their feet, it is eaſy to form theſe which are laid on the ground.

At the ſeveral angles of the plan erect perpendiculars, and give the ſide on the ground the ſame dimenſions as when it was ſtanding above it. For example, having erected perpendiculars from the angles, you will have the breadth M in the chair laid on its ſide, which is drawn to the point K. This meaſure M, being doubled, gives O for the bar at the bottom of the chair; and the perpendiculars raiſed from the plan, give the bar of the ſeat P: from which points, lines drawn to K, will cut the other perpendiculars of the front in the places required to ſhew the ſame bars on all the ſides they are viſible on. As to the height of the back of the chair, make it the ſame with the height of the ſeat; but for the back of that in the middle, you are to draw a double diagonal, and obſerve where it cuts the rays, or ſides, R S. The reſt is obvious.

The two other figures underneath, with their feet aloft, are eaſily performed. One of them is drawn to the point of ſight T, the other to the point of diſtance Y, X. The line of elevation is Y Z.

The method of raiſing them, is the ſame as for elevating thoſe upon their feet: that is, perpendiculars muſt be raiſed from the angles of the plan; and from the ſame angles, lines be drawn to the line of elevation; by which you will obtain the dimenſions of each of the upright parts, and the places of the croſs parts both of top and bottom.


103
N
K
Q
P
O
M
M
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S
S
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G
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T
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Y

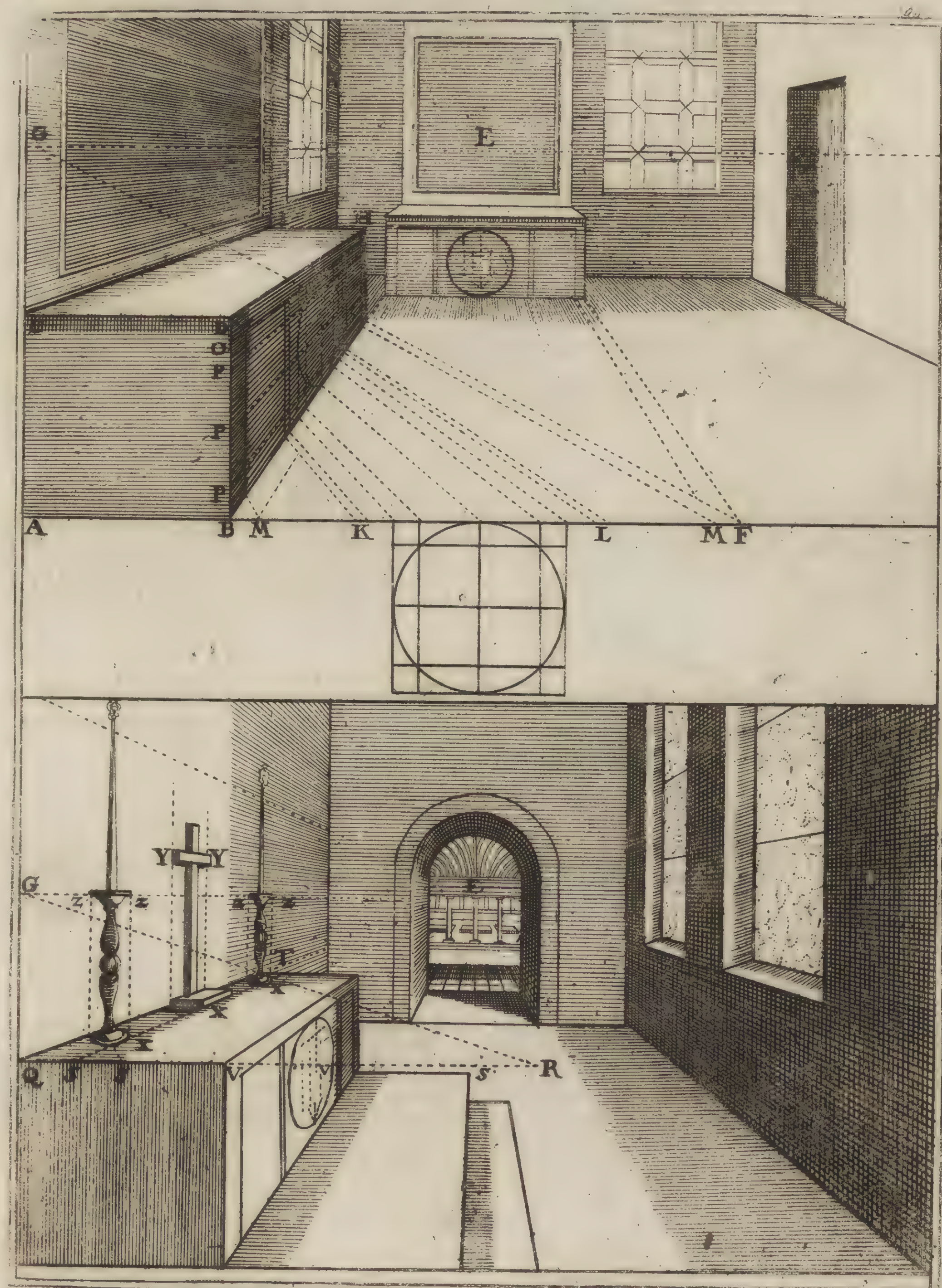
To exhibit ALTARS *in perſpective.*

THE method for raiſing altars is the ſame as that for frames of long tables, all that is farther to be done, relates to the circle in the middle, the edges of the cloth and the laces; of each whereof in its place.

In raiſing the *altar* here viewed in front, there is but little difficulty; for having adjuſted its height and length, there remains nothing but to draw lines from all the points on the baſe line to the point of ſight E; and from the interſections thoſe lines make with the bottom of the altar, erect perpendiculars, which being joined by a parallel at the proper height, give the front, and rays drawn to the point of ſight E form the ſides. As to the circle in the middle it is ſtruck with compaſſes. The reſt is obvious.

For a *ſide-altar* ſet the intended breadth and height in the place where you would have it begin; as the breadth A B, and the height B D in the figure. Then, from B, D, and C, draw lines to the point of ſight E: and ſince B F on the baſe line is the length of the front altar, and we would make this equal thereto, from the point F, draw a line to the point of diſtance G, and obſerve where is interſects the ray B E; and from the point of interſection raiſe a little perpendicular to touch the ray D in the point H. Then drawing a little parallel from H, it will give the point I in the ray C; and by ſuch means you will have the top of the altar, C D H I. For the two ornaments that are on each ſide the circle, they are found on the ray B E, by drawing lines thence to the point of diſtance G. M gives the breadth of the border of the altar cloth. Now taking the meaſure B M, ſet it off from D to O, for the breadth of the cloth at the top. As to the circle, I need not repeat what has been already ſaid of the method of putting it in perſpective. I ſhall only here obſerve, that lines muſt be drawn from all the diviſions thereof on the baſe line to the point of diſtance G; and in the interſections with the ray B, perpendiculars to be raiſed. Then, the ſame dimenſions to be taken and ſet off between O and B; as P P P, and from thoſe three points rays to be drawn to the point of ſight E, obſerving where they cut the perpendiculars raiſed from the other diviſions of the circle, and connecting thoſe points with a circular line, which gives the circle in perſpective. The method of diminiſhing would be the ſame, if in lieu of laces and a circle there were an embroidery.

In the figure underneath, the ſame altar is ſhewn free of lines and points, and farther adorned with a crucifix and two candleſticks. In order to this, the corner line of the altar muſt be prolonged, as Q R. Then, from the point of diſtance G, a line to be drawn through the corner of the altar T, and continued till it cut Q R; and the line Q R will be the length of the altar, equal to B F in the firſt figure. Hereon muſt the dimenſions of the croſs and candleſticks be laid; for example, V for the croſs and S S, *&c.* for the candleſticks. From all the points S and V, lines to be then drawn to the point of diſtance G, and through their interſections with the ray Q E, little parallels to be drawn; which cutting the ray S E, give ſquares upon the altar, X X, *&c.* for the crucifix, and candleſticks. This ſquare muſt be left for the foot of the crucifix; and from the middle of the ſquare, the crucifix is to be raiſed. For the proportions of the arms of the crucifix, erect occult perpendiculars from the angles of the ſquare, as here Y Y; and draw lines to the point of ſight E, for the candleſticks. Then turn the ſquares, for their feet, into circles, and obſerve where they interſect the diagonal: For perpendiculars erected from the points of interſection, give the breadth of the baſons or ſtands; and lines drawn to the point of ſight, the height. Laſtly, from the middle of the foot erect a perpendicular for the body of the candleſtick, and the taper therein, which is to be made high or low at pleaſure. To proportion them, draw a line from the top of the firſt to the point of ſight E. The reſt as already ſaid. The figure will call to mind the methods.


E
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To exhibit the Fixtures of Shops *in* Perſpective.

TRADESMEN's ſhops are uſually encompaſſed with ſhelves, boxes or drawers, wherein their goods are diſpoſed.

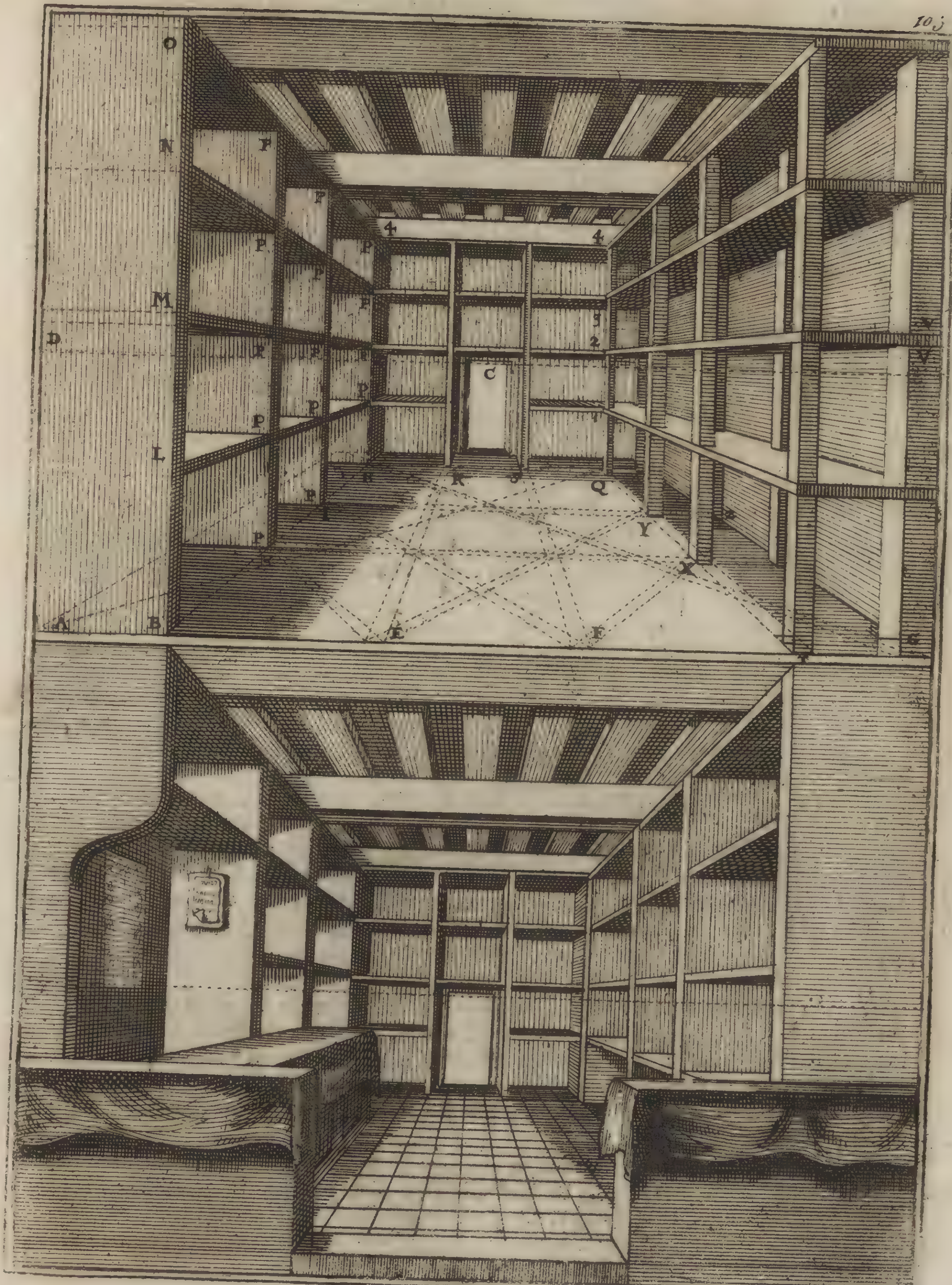
The rule for deſigning boxes, preſſes or ſhelves, is much the ſame as that already laid down for doors and windows; for example, in lieu of the thickneſs of the wall uſed in making a window, you are here to put the board A B, and from the point B, to draw a line to the point of ſight C. Then, for the width of the ſhelves or preſſes, having laid down the diſtances on the baſe line in E F G, from theſe points draw lines to the points of diſtance D. Theſe make interſections H I K, with the ray B: from which interſections, perpendiculars being raiſed, will give you the upright diviſions.

For the croſs boards, ſet any number thereof at pleaſure on A B, or only on the firſt perpendicular B O; ſuch are here L M N O: from all which draw rays to the point of ſight C, and at their interſections with the perpendiculars in the points P P, draw little parallels to the baſe line, which will ſhew the top and bottom of each ſhelf, and ſeparate them from the ſides.

As to the *front* diviſions and ſhelves, there only needs to draw rays from the points of meaſures E F, and in the points of their interſections with the lines Q S, to erect perpendiculars R and S. The croſs pieces are had, by drawing parallels from all the diviſions on the perpendicular K; as here, P 1, P 2, P 3, P 4.

As to the diviſions on the oppoſite ſide, where there are ſquare upright poſts to ſuſtain the ſhelves, their depth is had by drawing lines or rays from the meaſures T, G, to the point of ſight C. And to get their plan, or ſquare, lines are to be drawn from the meaſures A E F on the baſe line to the point of diſtance V, which give the interſection X Y Q on the ray T C. Through theſe interſections little parallels muſt be drawn till they cut the ray C G in Z; and from the angles of theſe little ſquares, perpendiculars are to be erected, which give the upright poſts, as in the figure.

The figure underneath ſhews a ſhop quite fitted up, and ready to receive goods of any ſort: for a bookſeller, it muſt be ſtocked with books; for an apothecary, with drawers and gallipots; for a draper, with pieces of cloth, ſtuff, *&c.*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2

Buildings *viewed on the* Outfide.

HAVING now confidered every thing relating to the interior parts of buildings, I proceed to give rules for the exterior.

Many of the methods already laid down for the infides may likewife ferve for the outfides; the procefs for the doors and windows is the fame in both cafes, and as thefe are very material, and diftinguifhing parts of every ftructure, the reader is already in great meafure qualified for the elevation of buildings. If they be adorned with orders of columns or pilafters, inftructions have alfo been given for thefe.

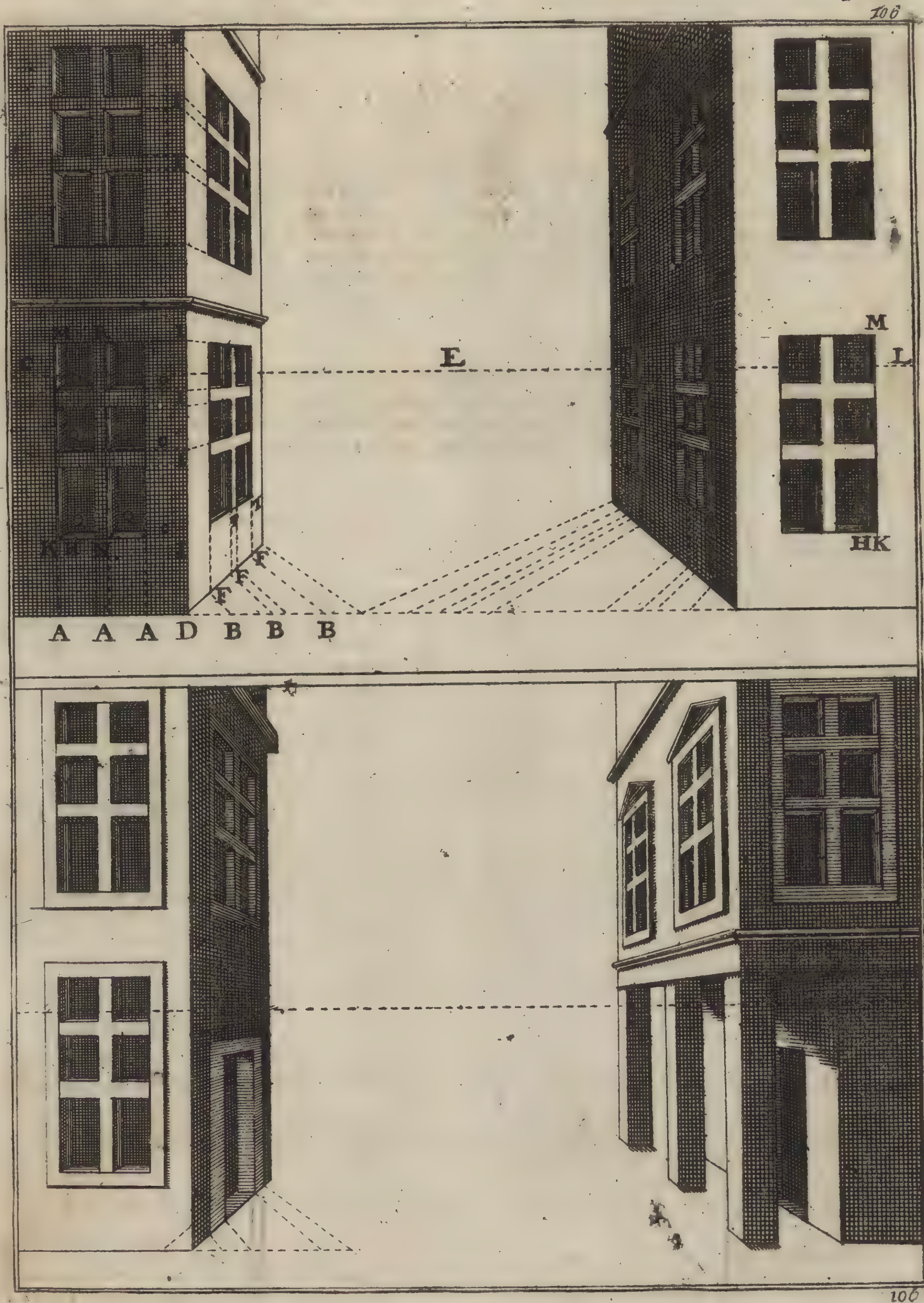
Suppofe there be windows in front, as A, and it is defired to have others in the fame proportions on the other fide, the proportions A A A muft be transferred to the bafe line, as here B B B, and lines be drawn thence to the point of diftance C: and in the points F F F, where they interfect the ray D E, perpendiculars to be raifed for the *uprights* in the window.

For the *crofs pieces*; thofe in the front window muft be continued to the perpendicular D, by which means you will have the points I I; from which lines are to be drawn to the point of fight E, which cutting the perpendiculars F, give the crofs bars in the fide-window.

If the number of windows were much greater, nothing farther would be required but to continue their rays, in order to make the meafure and height of the crofs pieces the fame in all. An inftance of which we have in the houfe on the other fide, which has two windows from the fame rays. As to the breadth or thicknefs of the pofts or crofs bars of windows in front, it muft be fet on one of the travers, as here on K H; and from the corner of the window K, a line be drawn to the point of fight E; and from the point H, another to the point of diftance C, for the window A, and to the point of diftance L, for the window on the other fide; and in the point, where thofe two laft lines interfect, a perpendicular, H M, muft be raifed. Then, from all the corners of the window lines to be drawn to the point of fight, and from the points Q Q, *&c.* where they interfect the perpendicular H M, parallels muft be drawn to give the thicknefs of the crofs bars. The thicknefs of the middle poft, N, will be had by drawing a line from the corner, N, to the point of fight; and in the points Q Q, where it cuts the thickneffes of the crofs bars, erecting perpendiculars Q R, Q R.

To fix the thicknefs of the windows on the other fide, it muft be fet in the corner of the wall, on the perpendicular D, as the diftance I O; and from the points O O, *&c.* lines muft be drawn to the point of fight E. Laftly, little parallels to be drawn from all the corners of the windows, as S T; which, interfecting the ray O, give the thicknefs in the point S. Thefe rules may ferve for all kinds of windows, both high and low.

In the figure underneath is fhewn a door diminifhed according to the rules delivered heretofore. As, in effect, every thing belonging thereto is very eafily underftood, and readily practifed, on fome or other of the preceding methods.


106
M
E
L
HK
F
F
F
A A A D B B B
106

To exhibit ROOFS *of Houses in Perspective.*

ROOFS are made of different heights according to the materials they are covered with. Those of *slate* are the most upright of all. Their usual measure is an equilateral triangle; that is, their slope, or the declivity of the roof, is equal to the width of the house. Thus, in the little figure at the bottom of the present plate, C A, or C B, is equal to A B. Others make the breadth A B equal to the punchion, or middle top, D C, which is higher. But that practice is much less usual than the former. For *flat tiles*, we only make the roof two thirds of the height of those of slate, or the width of the house, as in A E B. For *thatch*, the height is usually but half the width; and for *pan-tiles*, only one third; as A 9 B.

Before we go any farther it is to be observed, that what we call *punchion*, or middle top, is a timber raised perpendicularly on the beams that sustain the ridge, and wherein the rafters are all jointed. *Rafters* are the pieces of wood which form the declivity of the roof, as H I. The other pieces in the corners, which go to the middle top, are called *stays*, and are usually longer than rafters, as H K.

There are three kinds of roofs in use; pavilions, pinnacles, and pent-house-form. The first have four sides, the second only two, and the last but one.

To put a pavilion or turret, in perspective, the place of the middle top must be known, that the stays may be drawn to the same. For this reason it was that I made the geometrical plan L M N O; to shew, that a square, L M N P, is to be made of the breadth of the house L N, and two diagonals drawn through the same, intersecting in Q. Some put the punchion in Q, but that advances it too far, and renders the end of the declivity too squat. It has a much better grace when more upright. With this view, it should be approached towards the wall L N a third part of the distance Q R, which will bring it to the point S; from which point a perpendicular, S, must be drawn upon the line N P. Then the measures L T and T M are to be set on the base line, and lines drawn from them to the point of distance, which is here more remote than usual; and from the points, wherein they intersect the ray V, perpendiculars to be erected to the top of the wall, which will give the points X X; from which, parallels to the base line are to be drawn as far as the other ray I. Then, from the middle of the wall Y, a line to be drawn to the point of sight, cutting the parallels in the point Z, Z, &c. from which points the punchions are to be raised. To give them the proper height regard must be had to the materials intended for the covering, and the height to be adjusted thereby, according to the proportions already fixed. Thus, suppose the covering slate, an equilateral triangle, 1, 2, 3, must be made of the breadth of the wall; and from 3, a line be drawn to the point of sight, cutting the punchion in the point 4. To which point, lines being drawn from the corners of the house, will give the form of the pavilion.

For *pinnacle roofs* there need not so much ado. You are only to make an equilateral triangle, 5, 6, 7, of the breadth of the wall 5, 6, and the like for the other end of the wall, which will give you the point 8, Then joining 7 and 8, you will have the form and measure of the roof.

The figures on the other side shew the same thing unembarrassed with lines. The projecture standing beyond the roof is made at discretion.

The front house is covered with a pavilion, performed after the same manner as that on the side.

In the present figure, where the letters are, the horizon is placed very high, to shew the tops of the houses, and render the practice more easy and conceivable. But, as it is not often such a case happens, I have added the other figure at the top, wherein the horizon is as low as usual. Though the rule in itself is the same as that already delivered.

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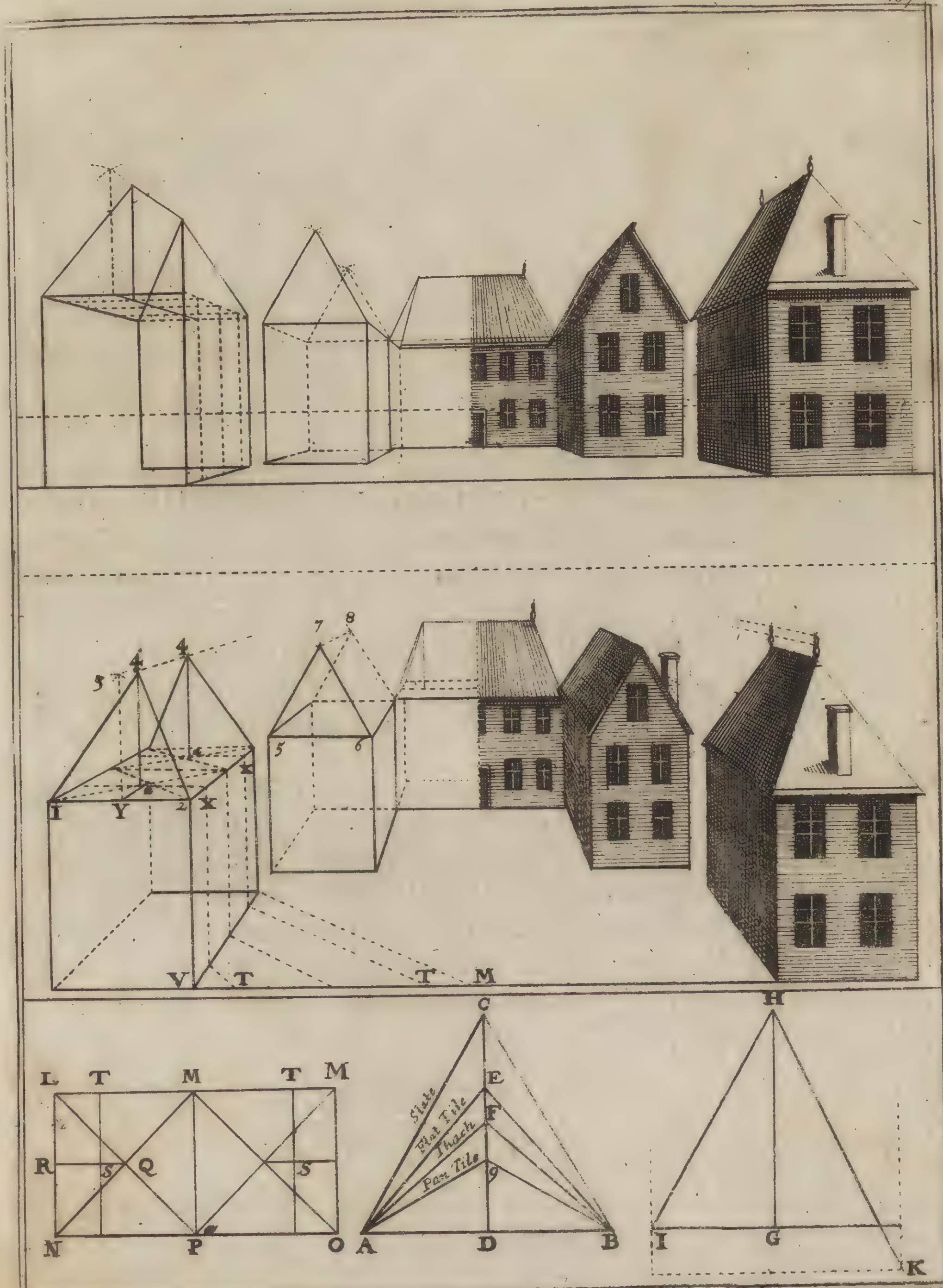

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Slate
Flat Tile
Thach
Pan Tile
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G
K

Sequel *of the* Roofs *in Perſpective.*

IN the preceding figure the *pinnacle roofs* are viewed in front, in this plate they are ſhewn laterally; the method for conſtructing them with their returns in the ſide-views is now to be given.

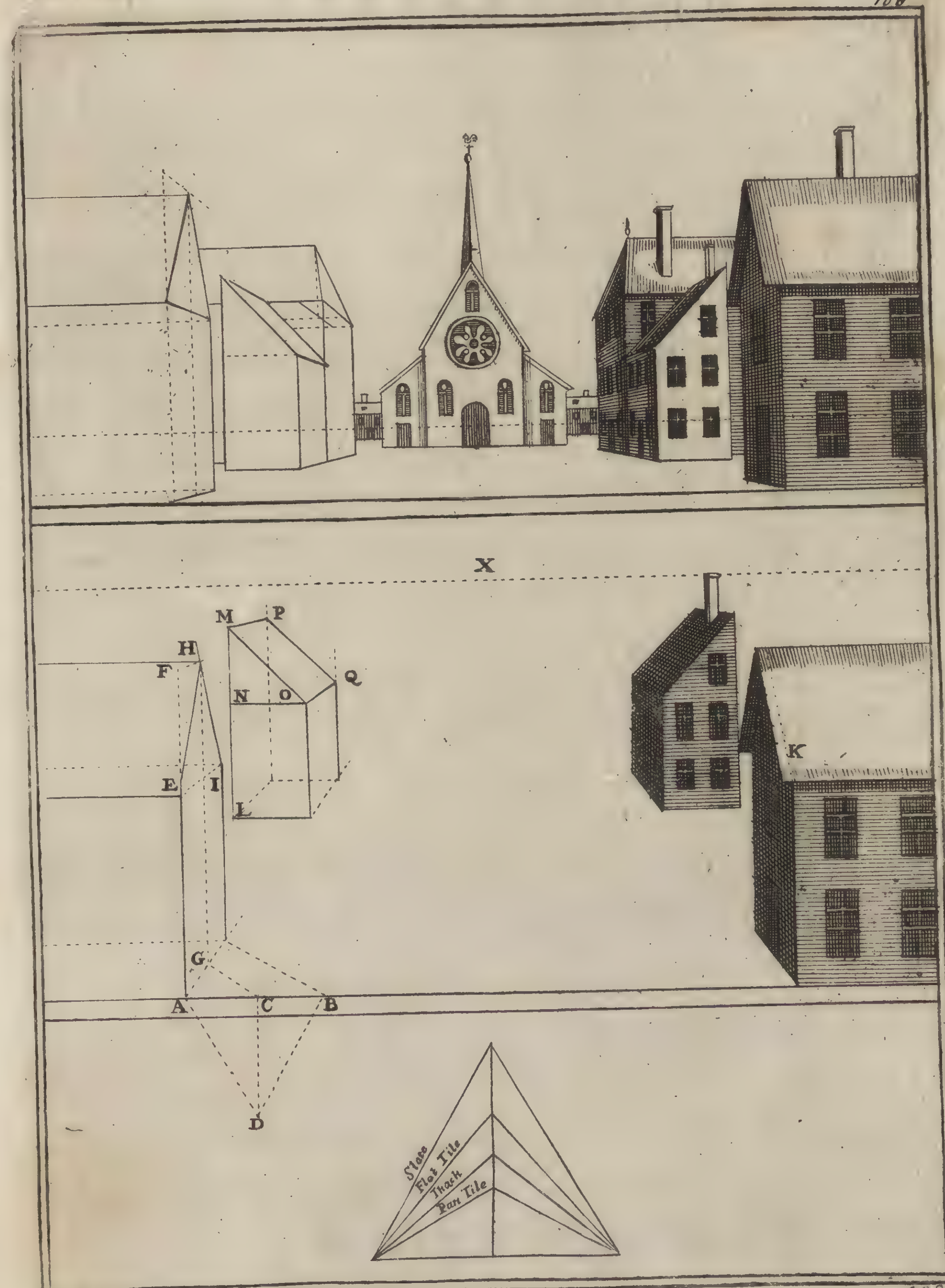
The width of the houſe muſt be ſet on the baſe line, as here A B; and of this width a triangle is to be formed with the dimenſions of the ſides according to the form of the roof. The preſent is an equilateral triangle, whereof C D is the height intended to be ſet perpendicularly on the corner of the houſe, at the height of the wall, as here E F. Then half the breadth of the houſe is to be laid down in C, which is the middle of A B; and from thence a line to be drawn to the point of diſtance; and in the point G, where it interſects the ray A, a perpendicular muſt be raiſed. Laſtly, from F, a line is to be drawn to the point of ſight X; the interſection whereof with the perpendicular H, will be the point, or tip of the pinnacle: to which lines muſt be drawn from the corners of the houſe, E I. If you would have eaves, they are eaſily added, as is ſeen in the figure K on the other ſide.

For the conſtructing of *pentices*, you have only to draw a line to the height of the roof, as here the line L M, and give it any declivity at pleaſure. In the preſent, the height of the roof M N, is the ſame with the breadth of the building, N O. If then, from the points M O, lines be drawn to the point of ſight X, the perpendiculars of the depth will be cut in the points P and Q; which being connected by a right line will form the roof. The figures on the oppoſite ſide ſhew houſes covered after ſuch manners.

The uppermoſt figures are only intended to ſhew that the ſame rule is to be obſerved, though the horizon be changed.

A church is ſeen in the middle, which is covered or roofed with pinnacles; and the wings with pentices.

There is alſo a pavilion viewed end-wiſe; mention whereof has been made in the preceding page.


X
M
P
H
F
Q
N
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I
L
K
G
A
C
B
D
Slate
Flat Tile
Thach
Pan Tile

To exhibit Rows of Buildings, *or* Streets *in Perſpective.*

A Bare ſight of the figure muſt ſuffice to ſhew the method, which is exceeding eaſy. All you have to do is to make a plan of ſimple ſquares, the common way; and to take one, or two, or three of the ſquares for the breadth or length of each houſe; and on ſuch breadth, *&c.* to ſet off the meaſures of the doors, and windows; and to get the diminutions by drawing lines from the ſeveral meaſures to the point of diſtance; as here from BCDE and F, the lines are ſuppoſed to be drawn to the point of diſtance A.

The firſt angle of each houſe may ſerve for a line of elevation, as the angle G for the firſt houſe. As to the roofs, I have already ſaid how they are to be managed.

If you require any croſs ſtreets, one, two, or three ſquares are to be left vacant, and nothing upon them, as here H and I.

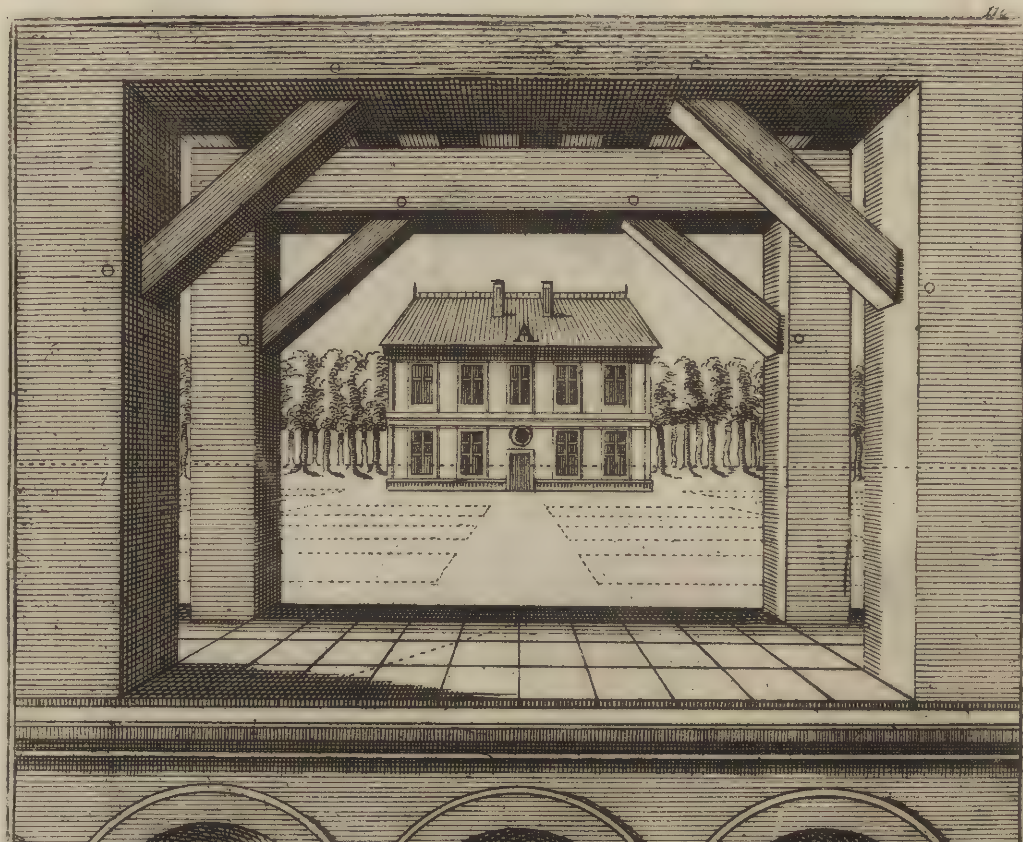
The figure underneath is to ſhew, that where houſes are to advance beyond others, or fall further back, you have only to put their elevations forwarder or backwarder on the plan of ſquares. Thus L advances a ſquare farther than K, and M farther than L; and ſo of the reſt.


A
F
E
D
C
B
G
H
K
L

A Demonſtration that remote Objects *do not ſhew their Thickneſs.*

IT muſt be here remembered, that objects near the horizon, that is, ſuch as are extremely remote, are not to ſhew any thickneſs when viewed in front. Thus, for example, the windows and doors of the houſes A, B, C, D, ſhould not have any thickneſſes ſhewn, but be expreſt only by mere lines. The reaſon is, that the viſual rays proceeding from the front parts of the object become united in the eye with the collateral ones.

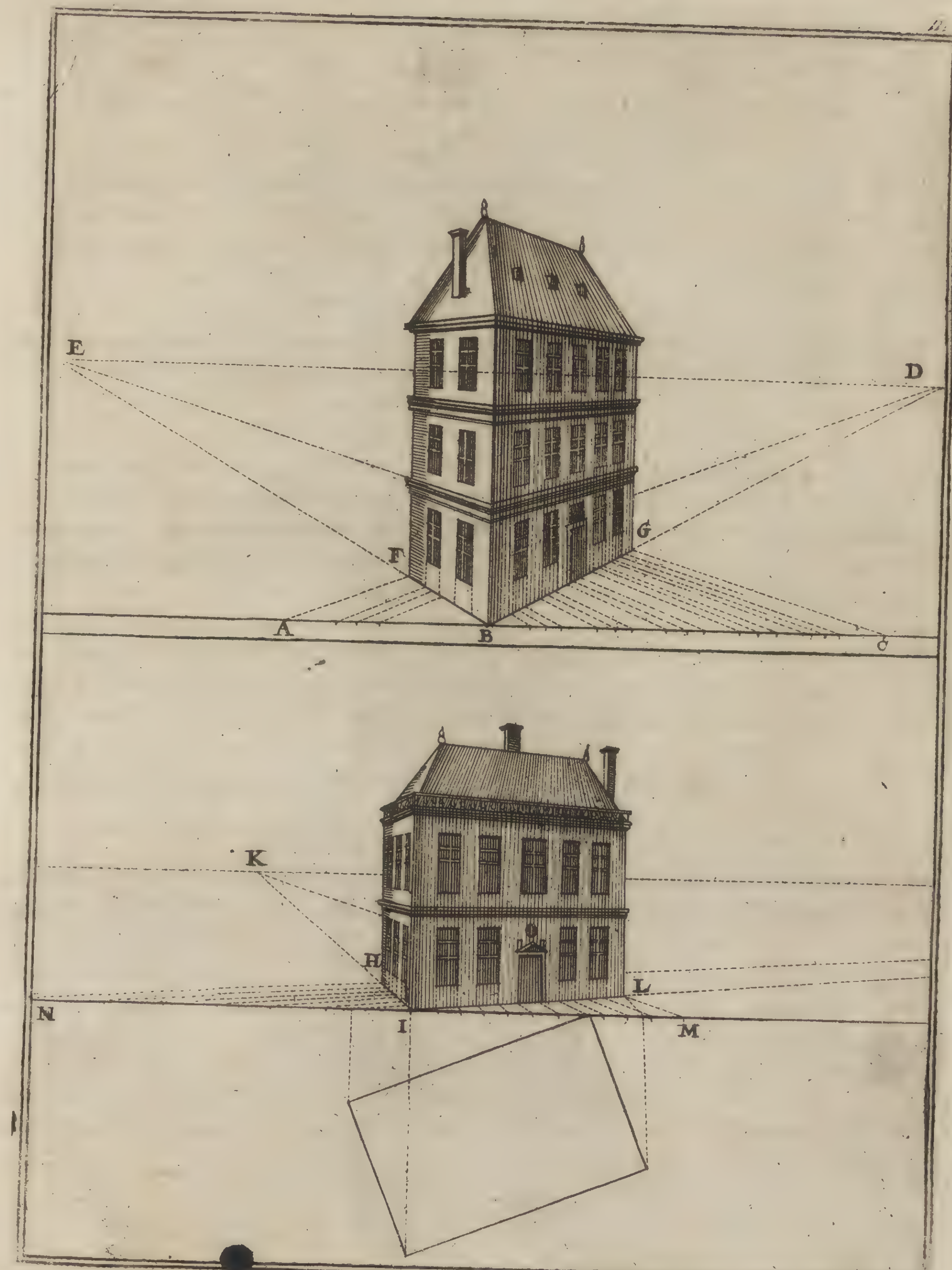
I ſhould have given a ſtrict demonſtration hereof, had I apprehended it any way neceſſary. But as I do not ſee of what uſe it would be, and as I ſtand engaged from the beginning of the book not to enter into ſuch demonſtrations, by reaſon I ſuppoſe I have to do with people who are but indifferently prepared to underſtand them, I decline it.


A
B
C
D

To exhibit BUILDINGS *viewed by the* Angle.

OF theſe two buildings ſeen angle-wiſe, the firſt is performed after the manner already delivered for ſquares viewed by the angle, and elevations of other objects in ſide-views. However, to ſave the trouble of recurring to the one and the other, I ſhall here obſerve, that to perform ſuch buildings the meaſures muſt be ſet on the baſe line, and from each of them, lines be drawn to the point of diſtance, and from the points of interſection perpendiculars to be raiſed; the perpendicular raiſed on the firſt angle ſerving for a line of elevation. Thus, in the preſent building, the breadth being A B, and the length, B C, double its breadth; from A and B, lines are to be drawn to the point of diſtance D; and from B and C to the point of diſtance E; and from the interſections B F and G, perpendiculars to be raiſed for the corners of the houſe. As to the dimenſions of the doors and windows, they muſt be laid down on the baſe line between A B and B C; and lines be drawn from them all, to the points of diſtance D and E. Then, obſerving where B D or B E are interſected thereby, raiſe the poſts of the windows therein. The perpendicular of the firſt angle B ſerving for a line of elevation, will give the croſs pieces, and the height of the windows. The reſt is obvious.

As to the figure underneath, the method is the ſame as for chairs placed irregularly, ſee page 102; that is, having made the plan, put it in perſpective as irregular objects are put. Then, laying a ruler along each ſide of the plan, obſerve where it cuts the horizon, and marking thoſe accidental points, draw lines to them from each part of that ſide of the building. Every ſide or face of a building has its particular point. Thus the plan being put in perſpective, the ſide H I, gives the point K on the horizon, to which all the rays on that ſide muſt be drawn. The other ſide I L, ſhould likewiſe have its point; but for want of paper-room, we could not here expreſs it. Theſe two points found, a ruler muſt be laid thereon, and an occult line drawn over the other ſide of the building parallel upon the plan to that which gave the point in the horizon, and continued to the baſe line; as from R, through L to M; and from the other point continue an occult line through H to N. Then ſetting the number of windows of the ſide H I, between N and I; and between I and M, ſetting the number of windows on the ſide I L, draw lines from all theſe points, or meaſures on the baſe line to the points in the horizon, and proceed as in the figure above.


E
D
F
G
A
B
C
K
H
L
N
I
M

To exhibit Walks, *with Rows of Trees, in Perſpective.*

THOUGH the preceding rules might furniſh ſufficient inſtructions for putting walks with trees in perſpective; I have judged it not amiſs to add a particular rule which may render the method ſtill more eaſy.

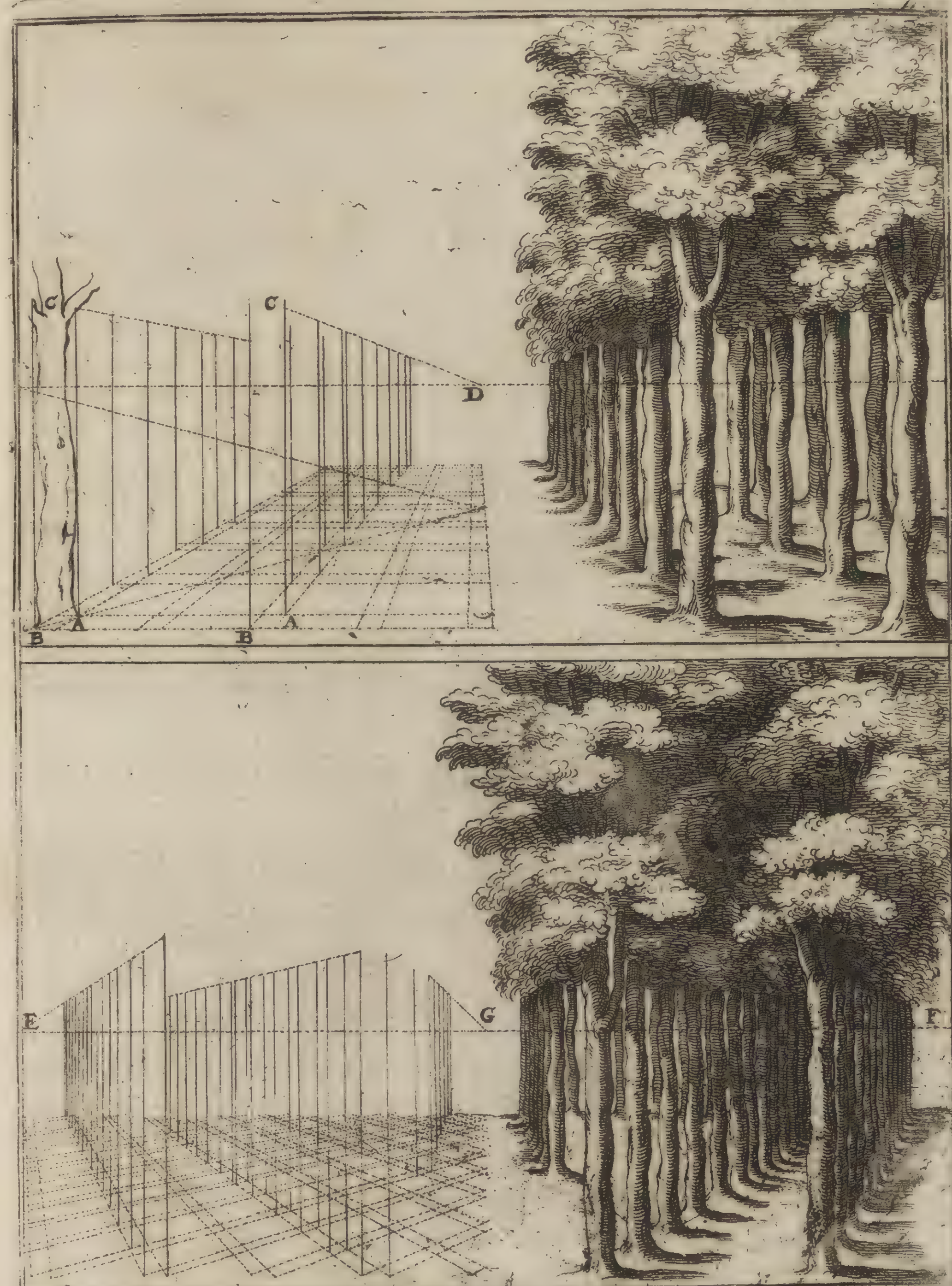
If only a ſingle row of trees on each ſide be required, there is no need for making a plan of ſquares, or chequers: what is directed in page 17, will ſuffice.

But where a number of walks are to be ſhewn, I think it adviſeable to form a plan in occult lines, as already taught in page 31, and from the diagonals of the little ſquares, to erect perpendiculars, as is ſhewn in A B. If you deſire to have the trees farther or leſs apart, increaſe or diminiſh the diſtances of the ſquares on the baſe line.

When you have given the ſtem of the firſt tree its proper height, as A C, draw a line from C to the point of ſight D, which ray C D is to bound the ſtems of all the other trees. The firſt tree, A B, ſhews that you may give what turn or form you pleaſe to the body of it between the two perpendiculars A B, for it ſhould not be drawn with the ſtraightneſs of a ruler.

The figure underneath is performed as that above, all the difference is, that the ſquares of the upper are direct, or in front; and thoſe of the under are viewed angle-wiſe: whence the meaſures on the baſe line, in the latter caſe, muſt be all drawn to the points of diſtance E and F. Perpendiculars are to be raiſed from the angles of the little ſquares; and the reſt as above.

In the ſame perſpective, wherein are walks drawn to the points of diſtance, one may add others, drawn to the point of ſight. Thus the middle walk tends to the point G, which is the point of ſight; and the others to the points E F, which are thoſe of diſtance.


C
C
D
B
A
B
A
E
G
F

To put Gardens *in Perſpective.*

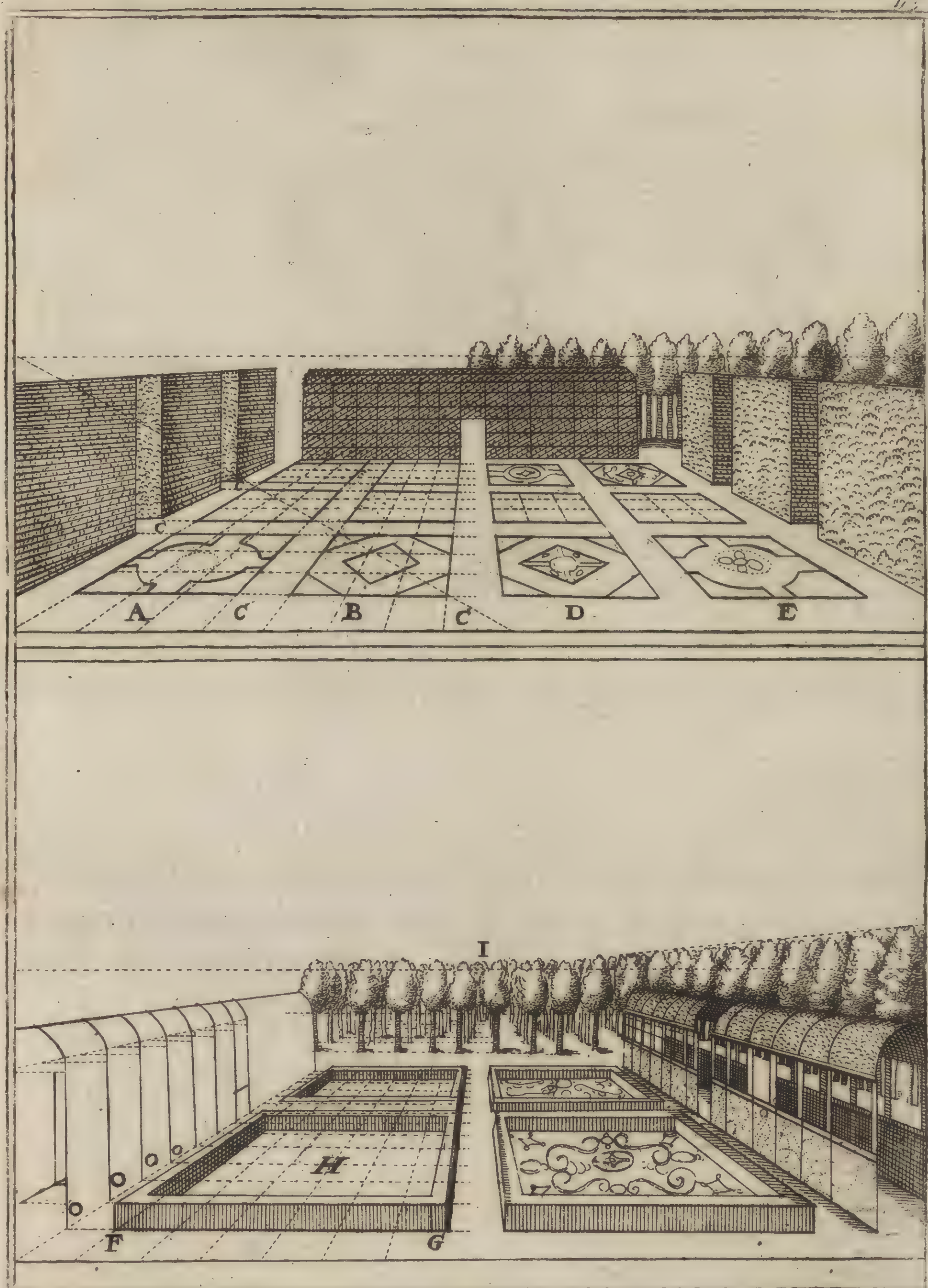
IN the doctrine of plans was ſhewn, page 35, the manner of diminiſhing, or putting the plan of a garden in perſpective, by an eaſy rule; ſuppoſing that you have the plan thereof. But, as I always endeavour to avoid geometrical plans, by reaſon it takes up too much time to make them, I have added the preſent figures; whereby it appears, that having made a chequer, or plan of ſquares, you may take as many or as few of them as you pleaſe for the beds of the garden. As here, A and B have each of them three ſquares every way; the reſt ſerving for walks, as C C. If you would have compartments, or knots in the beds, you are to uſe the little ſquares or diviſions of each bed; cutting them, and forming them into the figure required; as is ſhewn in the ſquares of A and B; and thoſe of the other ſide, D and E. The paliſades and arbours are cut through the breadth of the walks.

To exhibit Beds with Borders, Arbours, and Groves.

WHEN Borders are to be given the beds, the intended heights and breadths muſt be ſet on the corner; and from thoſe meaſures lines muſt be drawn to the point of ſight. Thus, in the lower figure, F G being the breadth and depth of the borders of the bed H, lines muſt be drawn from the angles of the little ſquare F and G, to the point of ſight I; and go on with the reſt, as abovesaid.

To exhibit *arbours*, raiſe upright poſts, or perpendiculars, O O, from the angles of the ſquares of the walk, and perform the reſt as already directed for arches viewed ſide-wiſe, in page 60.

The *grove* in the middle is performed by erecting perpendiculars from all the angles of a chequer, *&c.*

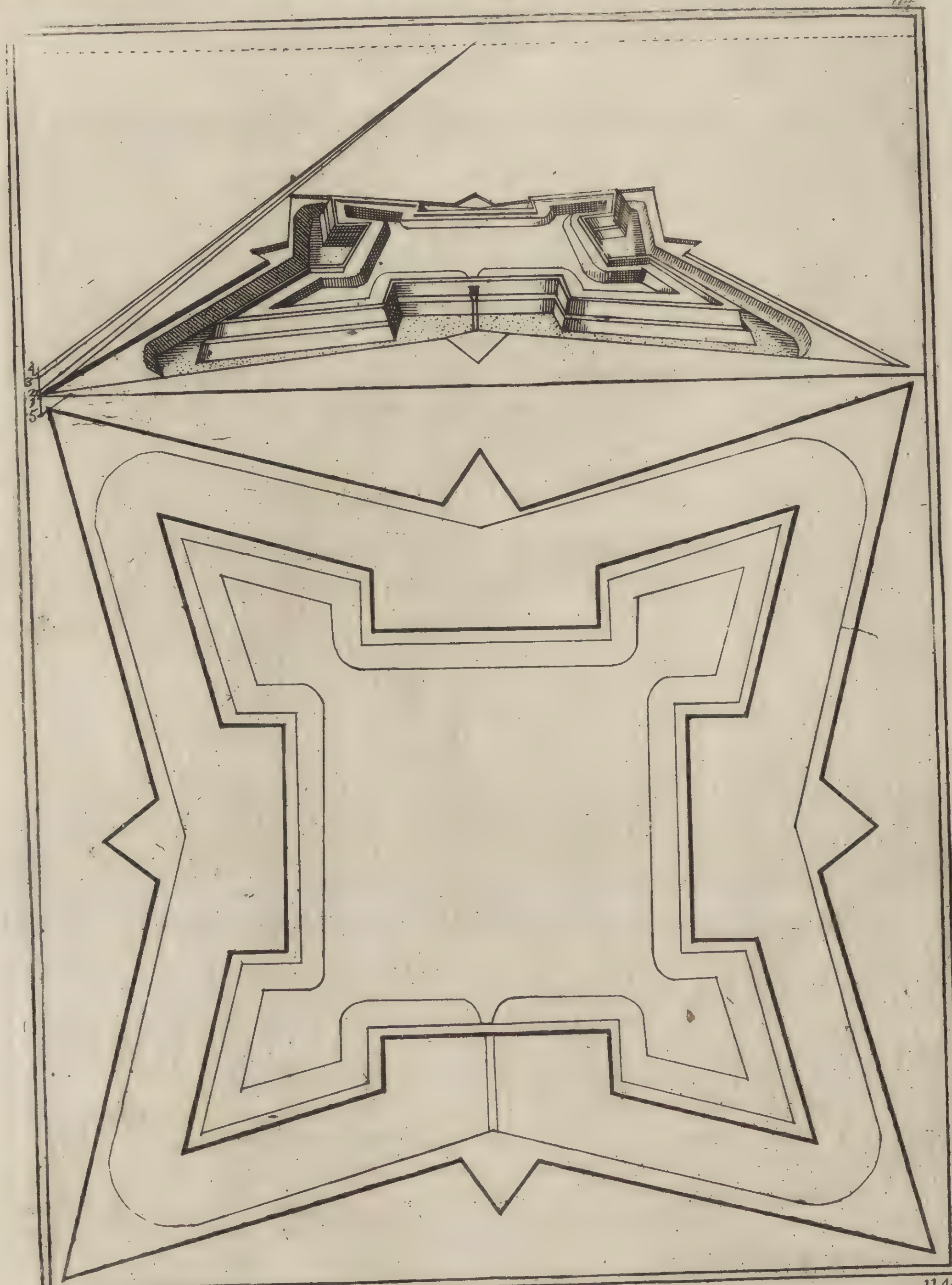

C
A C B C D E
I
H
F G

To put Fortifications *in Perſpective.*

I Need not here repeat the method of diminiſhing, or putting in perſpective, the plans of all ſorts of fortifications: what has already been ſaid in page 39, is clear enough.

There is no more difficulty in raiſing them than in the elevation of a bare wall; only more time is required, by reaſon of the greater number of angles which are to be drawn all to the line of elevation, to give their heights thereon; as has been mentioned over and over in treating of other works.

The little line of elevation is divided into four parts. The firſt, from 1 to 2, is the height of the *parapet of the covered way.* From 2 to 3, is the height of the *rampart.* From 3 to 4 is the height of the *parapet of the rampart*; and from 5 to 1, the depth of the *ditch.*



114

To make Deſigns *in Perſpective.*

THERE is no maſter ſo excellent, but he makes deſigns of the works he would ſucceed in. If this be uſual in moſt arts, it is neceſſary in this, by reaſon of the great number of points and lines to be ſtrictly obſerved, and nicely managed, without which nothing is to be done correctly, or in any wiſe pleaſing to a perſon that has taſte or ſkill.

Since then there is a neceſſity of making deſigns, we are to look out for what may be aſſiſtant therein. And as every body knows that the length and tediousneſs of ſuch works lie in the drawing of parallels and perpendiculars, I have ſought, both in authors and in experience, for a method of doing the ſame as expeditiouſly as poſſible. The reſult is, that nothing of this kind has appeared to me worth the recommending, but the plate and ſquare, which *Viator* has left us in his writings; which are inſtruments ſuch people as have occaſion to ſpend much time in deſigning will find a deal of eaſe and benefit from.

The figure gives a tolerable notion of the inſtrument, and the method of uſing it, but it may be convenient to give ſome deſcription thereof. The plan A B C D, then, is to be perfectly on the ſquare, a foot and half long, fifteen inches broad, and half an inch thick. The wood to be dry, firm, and ſmooth. To make it the ſofter, and favour the pen, a ſheet of paper may be ſtruck on it.

The ſquare E F is a ruler a foot and a half long, an inch broad, and a quarter of an inch thick, fitted at right angles in another ruler G H, eight inches long, one broad, and three quarters of an inch thick. Now to draw lines, this laſt ruler, G H, is held cloſe to the board A B C D, in which caſe the other ruler E F, is certainly parallel to the baſe line, provided the board and ruler be exactly formed.

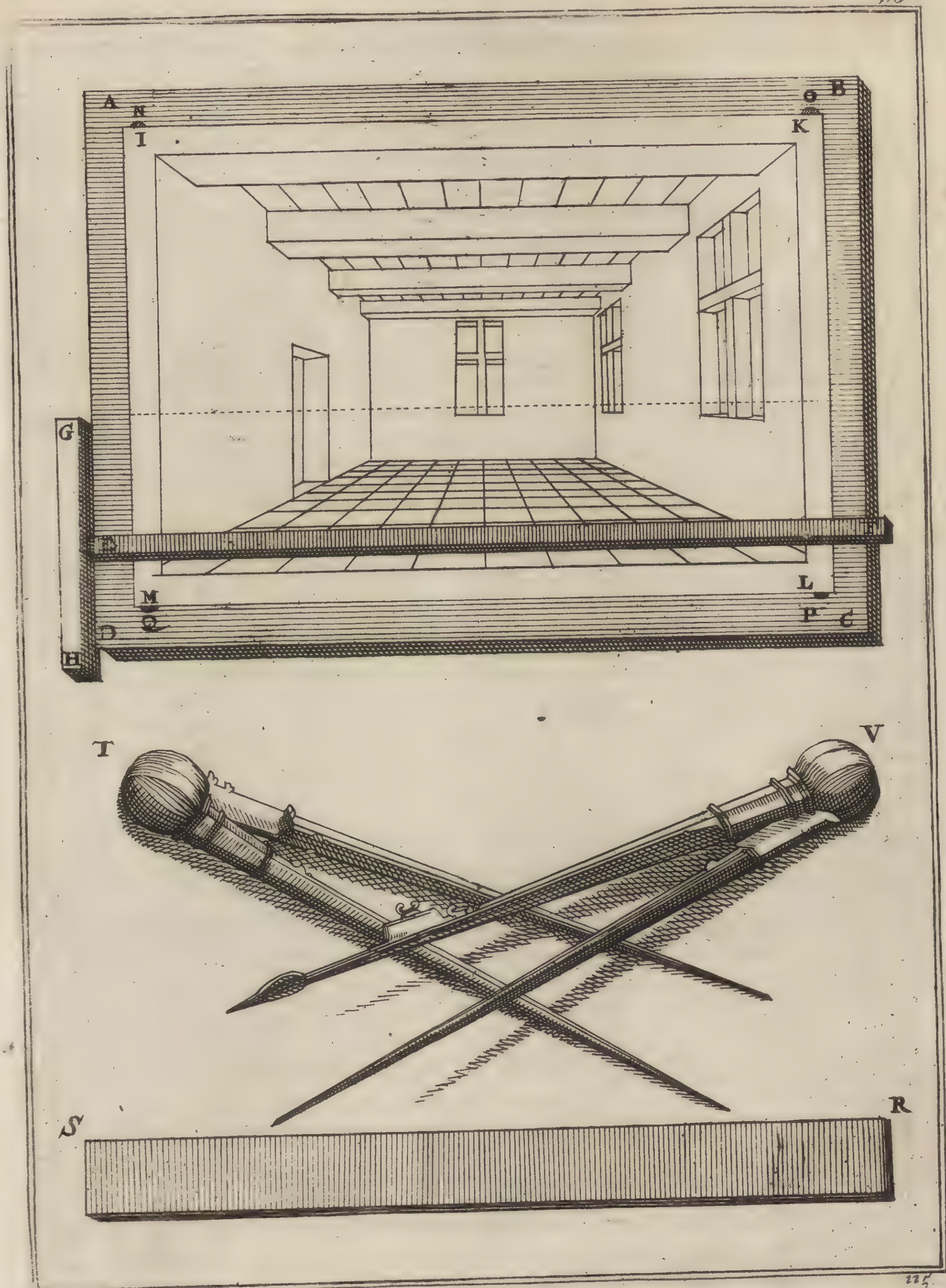
When you go to work, faſten the ſheet of paper I K L M, on the board with four little pieces of wax, N O P Q; then may you draw lines from any point, ſecure that they are right. And for raiſing perpendiculars, you have only to lay the handle of the ruler, G H, on the ſide G D, in which caſe E F will be perpendicular to C D.

For myſelf, I find a wonderful eaſe herefrom. The truth is, without ſuch a contrivance, a man muſt never be without the compaſſes in his hand. All the trouble now remaining is for the viſual rays. And for theſe, ſome uſe a ruler perforated at one end, and faſtened by a needle to the point of ſight. But this is to run into a trouble greater than what you would avoid. The common ruler does every whit as well.

S R *is a common ruler.* T a *pair of compaſſes.* V another *pair of compaſſes,* with a drawing pen therein; for circular lines.

Theſe are all the inſtruments neceſſary for making of deſigns in perſpective.

6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The Method of enlarging perſpective Draughts out of Small into Great; and of reducing great Ones, into leſſer.

AS deſigns are more eaſily made of a ſmall, than of a large ſize, it is but reaſonable they ſhould always be ſo made. This has put me on giving a method of enlarging ſmall deſigns on the canvas.

The method commonly uſed by the painters is to divide their little deſign, and the canvas they intend the large ones to be on, into an equal number of little ſquares, and to transfer what is in the ſquares of the deſign, into the correſpondent ſquares of the canvas. This way ſome greatly approve of.

Here follows another, which, in my opinion, is eaſier and ſurer. Provide a ſcale proportionate to the little deſign, and another proportionate to the canvas. To make a deſign the firſt thing to be determined is the ſcale, which is to fix the meaſures of all the parts of the work. Thus, in the little deſign A, the ſcale B C of five parts, which we may call feet, is the firſt thing made. From this ſcale are taken the horizon, the height and diſtance of the trees, the breadths of the walks, *&c.*

To *enlarge this deſign* the method is this. Conſider whether or no the draught is to have its natural horizon, that is, whether, when the bottom of the painting is on the ground, the horizontal line be the height of the eye, which is about five feet. Then, of the five diviſions between B and C, make a ſcale of five feet F G, that thus, having taken all the meaſures and proportions in the ſmall one, you may transfer them to the great one, after the following manner.

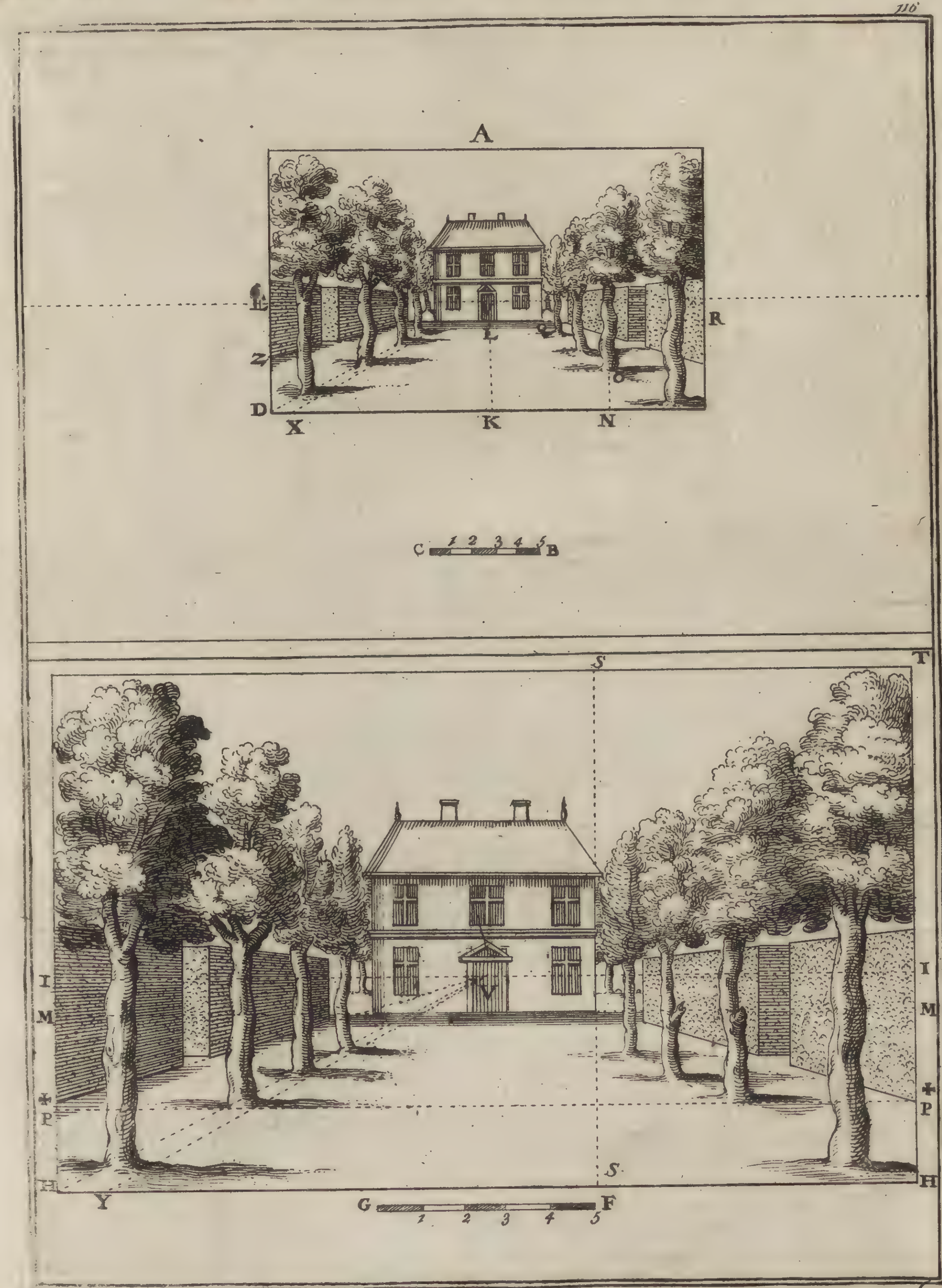
The two ſcales thus fixed, the firſt thing to be done is, to take in your compaſſes the diſtance between the baſe line D and the horizon E, and to apply the compaſſes thus opened, to the little ſcale B C, noting what number of parts it includes, as here it does five. Take therefore five diviſions on the large ſcale F G in your compaſſes, and ſet them on each ſide the painting, or large deſign, beginning at the bottom of the cloth H H, and ending in I I. From the points I I, ſtrike, or ſcore a line with a chalked or blackened packthread. This line I I, will mark the horizon in the large draught. Then take the diſtance, or depth, K L, of the little deſign, which gives the bottom of the houſe, note how many diviſions it includes, and take the ſame number from the large ſcale, and ſet them on the edges of the canvas, H M, H M, which you muſt ſtrike with a pack thread for the bottom of the houſe. Proceed to take the diſtance N O, which includes two parts of the little ſcale; accordingly two parts are to be taken on the great one, and ſet off from H to P, which muſt be ſtruck as before, for the depth of the ſecond tree. Do the ſame for all the parallels to the baſe line, as the other trees, windows, roofs, *&c.*

The method is the ſame for the perpendiculars as for parallels; only that they are to be ſtruck or ſcored not from the ſide, but from the top and bottom. Thus, for the two corners of the houſe, the interval between them and the ſide of the draught being taken in the compaſſes, and found on the little ſcale equivalent to ſeven diviſions and a half, as many diviſions muſt be taken from the great ſcale, by which you will have H S, T S, to be ſtruck as before. And the like muſt be repeated for all the other perpendiculars, as buildings, trees, paliſades, *&c.*

To find the viſual rays, which are the lines proceeding to the point of ſight V, faſten a packthread to this point V, of the length of the painting, and with this ſtrike or ſcore all the rays very exactly. Thus, for the two rays D X, which give the breadth of the trees in the little deſign, take the diſtance D X, ſet it one the little ſcale B C, and take an equal number of diviſions from the great ſcale, this will give you H Y; to which points H and Y, lines are to be ſtruck with the pack-thread, from the point V. For the ray of the paliſades, take the diſtance D Z, and ſet it on the little ſcale, and take as many diviſions from the large ſcale; by this means you will have H †, which are to be ſtruck from the point V, as before.

Every thing in a perſpective ordinarily comes under one or other of theſe three ſorts of lines, parallels, perpendiculars, and viſual rays: and having ſhewn how to deſcribe theſe with a good deal of eaſe on the canvas, there remains nothing difficult in the proceſs of enlarging a ſmall deſign.

As to the reducing *great into little,* you have only to invert the proceſs; that is, take the meaſures firſt on the large ſcale, and diminiſh them proportionably on the ſmall one. Thus, if the horizon of the large deſign were five diviſions of the large ſcale, five diviſions of the ſmall ſcale were to be taken for the height of the horizon of the ſmall deſign. And ſo of the reſt.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Apparatus *to the univerſal Method of the Sieur* G. D. L.

AS ſeveral, for whoſe benefit I intend this work, may not be ſufficiently ſkilful to ſee clearly into this univerſal method of the Sieur G. D. L. the author, I believe will allow me to make it as eaſy as I can, that they may be the better enabled to reap the benefit thereof. For this reaſon I have added the two following figures, which will call to mind what has been already touched upon in the ſecond, third, fourth and fifth obſervations, pages 16, 17. The deſign whereof was to facilitate this method, and accordingly in them is ſhewn how to take all the meaſures on the baſe line; and that as many rays as cut the diagonal C F, ſo many ſquares are formed in the depth of the draught; which ſquares may be made of any magnitude at pleaſure.

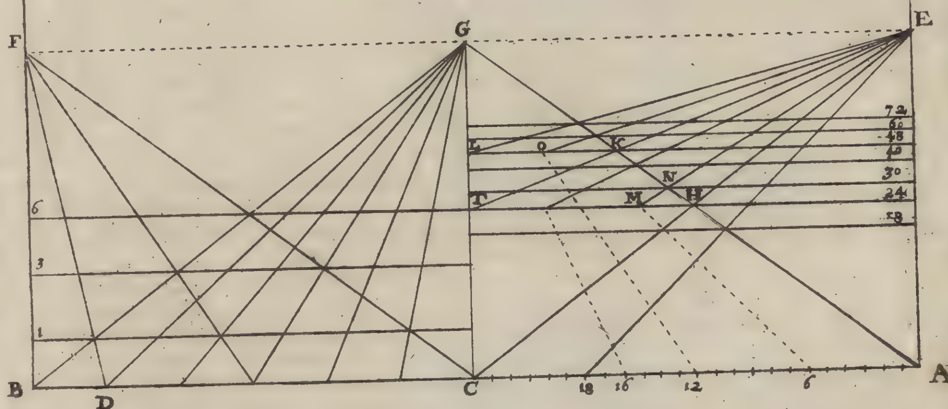
Now, not to have ſo far back to ſeek, view the firſt figure, where the baſe line is A B, the point of ſight G, and the points of diſtance E, F. This baſe line I divide into twelve equal parts, which I ſuppoſe equivalent each to one foot, from all theſe diviſions draw lines, or rays, to the point of ſight, whereof A and B are the laſt. Now, if a line ſhould be required that is ſunk a foot deep in the draught, draw a line from the firſt diviſion B D, to the point of diſtance F; and where this line D F cuts the ray B G, will be the point for a line to be drawn through, that is ſunk a foot. If another three feet deep were required, take three of theſe parts on the baſe line, and from the third draw a line to the point of diſtance F, and the point where it interſects B G, will be the place for that line. Conſequently, if from C a line be drawn to F, the point where C F cuts B G will be a line ſix feet deep.

If of the other ſix parts remaining of A C, you make twenty four, by dividing each into four, and yet account each diviſion a foot, you will have twenty four feet between A and C; ſo that if a line ſhould be required eighteen feet deep in the draught; I would reckon eighteen little parts from A, and from the eighteenth would draw a line to the point of diſtance E, which by its interſection with A G would give a point for that line. If a line were required twenty four feet deep, the whole line A C muſt be taken, and from C a line be drawn to E, and from H, the point wherein C E cuts A G, the line H I muſt be drawn, to appear twenty four feet deep in the draught.

In perſpective, the line H I is equal to that of A C, that is, contains as many parts, or feet. So that if from I, a line be drawn to E, the interſection of I E with A G, will give the line K L forty eight feet deep. And if from the point L, a line be drawn to the point of diſtance E, by its interſection with the ray A G, you will have a line twenty four feet farther off than the other.

If you would have a line thirty feet deep, from the point A reckon ſix ſmall diviſions, and from the ſixth draw a line to the point of ſight G, obſerving where it cuts the line H I, as here in the point M. Then from M draw a line to the point of diſtance E, and the line M E will interſect the ray A G in the point N, through which the line required muſt be drawn. If a depth of forty feet were required, from A ſixteen diviſions were to be reckoned, and the reſt to be done as before. If ſixty feet be required, twelve diviſions muſt be taken, and from the twelfth a line be drawn to the point of ſight G, as far as the line K L, which will give the point O. Then from O, a line to be drawn to the point of diſtance, and its interſection with the ray A G, will give the line.

As to the ſecond figure, from what has been ſaid it is eaſy to find a point of any depth or diſtance at pleaſure. It remains to ſhew how the ſame is found within or without the rays A G or B G. In order to this, the line B C is to ſerve as a ſcale of ſix feet, one of which we divide into twelve inches; that we may have the half, third, fourth, *&c.* of a foot. Things thus diſpoſed, if it be required to ſhew a point ſeventeen feet diſtant, and a foot and half within the ray A G, a line muſt be drawn from the ſeventeenth diviſion of the baſe line, to the point of diſtance E, and where the ray A G is interſected thereby in P, the line P Q to be drawn. Now ſince a foot and half is required within the ray A G, I take the extent on the ſame line N Q in my compaſſes, and ſet it off from P to R, which point R is the point required. If a point twenty nine feet diſtant, and ſeven and a half within the ray A G be required, a line muſt be drawn from C to the point of diſtance E, and through the point where it cuts A G, a line being drawn, gives twenty four feet. Then, from A taking five leſſer parts, a line muſt be drawn from their extent to the point of ſight G, till it cut that line in the point S; and from S a line is to be drawn to the point of diſtance E, and from the point wherein it cuts the ray A G, a line T V muſt be drawn. And ſince ſeven feet and an half are required beyond the ray A, that ſpace muſt be ſet on the ſame line from T towards V to the point X, which point X will be the point deſired. After ſuch manner, may any diſtance at pleaſure be determined.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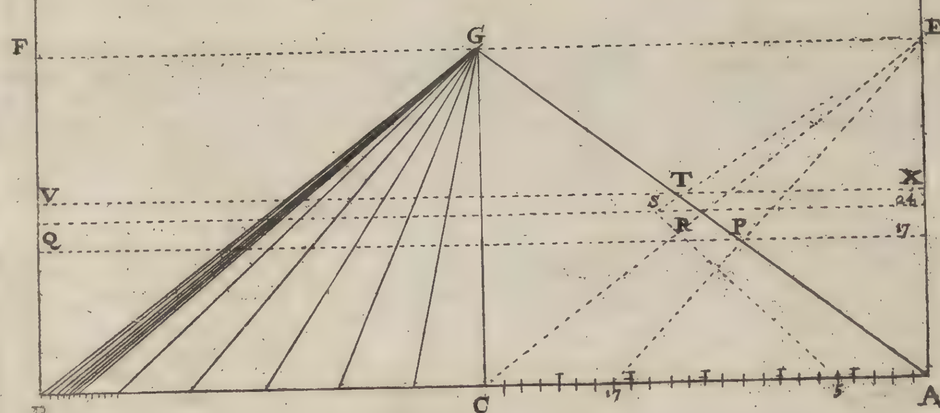
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An universal method of performing Perspective without having the point of distance out of the painting, or Ground of the work; made public by the Sieur G. D L.

IN this method a geometrical plan is required, or at least a scale of measures both for the plan and the elevation, in order for the one or the other to be put in perspective.

For an object or subject, we shall take the author's own example, which is a square cage, terminating at top in a point, or a building with a pavilion roof. The measures whereof shall be given by a scale.

Now having made the plan of the cage M I L K, which is here added at the top of the figure, a line *a b*, must be drawn at the distance the object is to appear at in the draught, as here the line *a b*, 17 feet, which is to be the base line, or bottom of the piece, and to be placed accordingly to the aspect the object is to be viewed in. Then, from the two extremes of the line *a b*, two indefinite lines must be drawn parallel to each other, as the line *a g*, and *b g*. On one of which lines, as *a g*, you are to draw little parallels to the base line, proceeding from the angles of the plan, and by means of the scale see how far each angle of the plan is removed from this line *a g*, and mark the same on each line. Then, from the place the painting is intended to be viewed from, which is here the point *c*, five feet distant from *b*, describe a perpendicular to *a b*, namely, the line *c t*; and to this line allow as many little parts of the scale, as the spectator is to be distant to view the painting, namely, 24 feet. At the extreme of which 24 feet, which is the point *t*, erect a little perpendicular of the height of the eye, namely, the line *t f*, equal to four feet and an half.

The cloth, wall or paper thus disposed for putting the plan in perspective, and making the elevation on the plan, divide the base line A B, in o as many parts as *a b* in the plan is divided into, namely twelve, each accounted a foot; and over the points A and B, set the height of the line *f t*, namely four feet and a half; that is, taking in your compasses four and a half of the divisions of A B, set them perpendicularly over the points A B, by which means you will have the points E and F. Draw the line E F, therefore parallel to A B, and it will be the horizon. Then, as in the plan, the point C, which is the place the draught is to be viewed from, is five divisions distant from *b*, you are to reckon as many parts from B; and from the fifth C, erect a perpendicular to A B, which cutting the horizon in the point G, gives the point of sight G, to which all the rays A G and B G, representing the parallels of the plan *a g* and *b g*, must be drawn.

As to the point of distance, it will be the point F, and as the line *c t* is 24 feet long, 6 divisions must be taken from the line A B, namely, from A to D, and each subdivided into 4: which 24 parts are to serve as a scale for the depths or distances, being sufficient for the same; though they were infinite. And the 6 parts remaining between B and D, will be a scale for the feet, according as the lines drawn from the points found for the plan, shall cut the rays drawn to the point of sight G. For as this scale is a pyramid, whereof B D is the base; the measures diminish in proportion as they are farther off. One of the parts is divided into inches, that all the measures may be there, as on the plan.

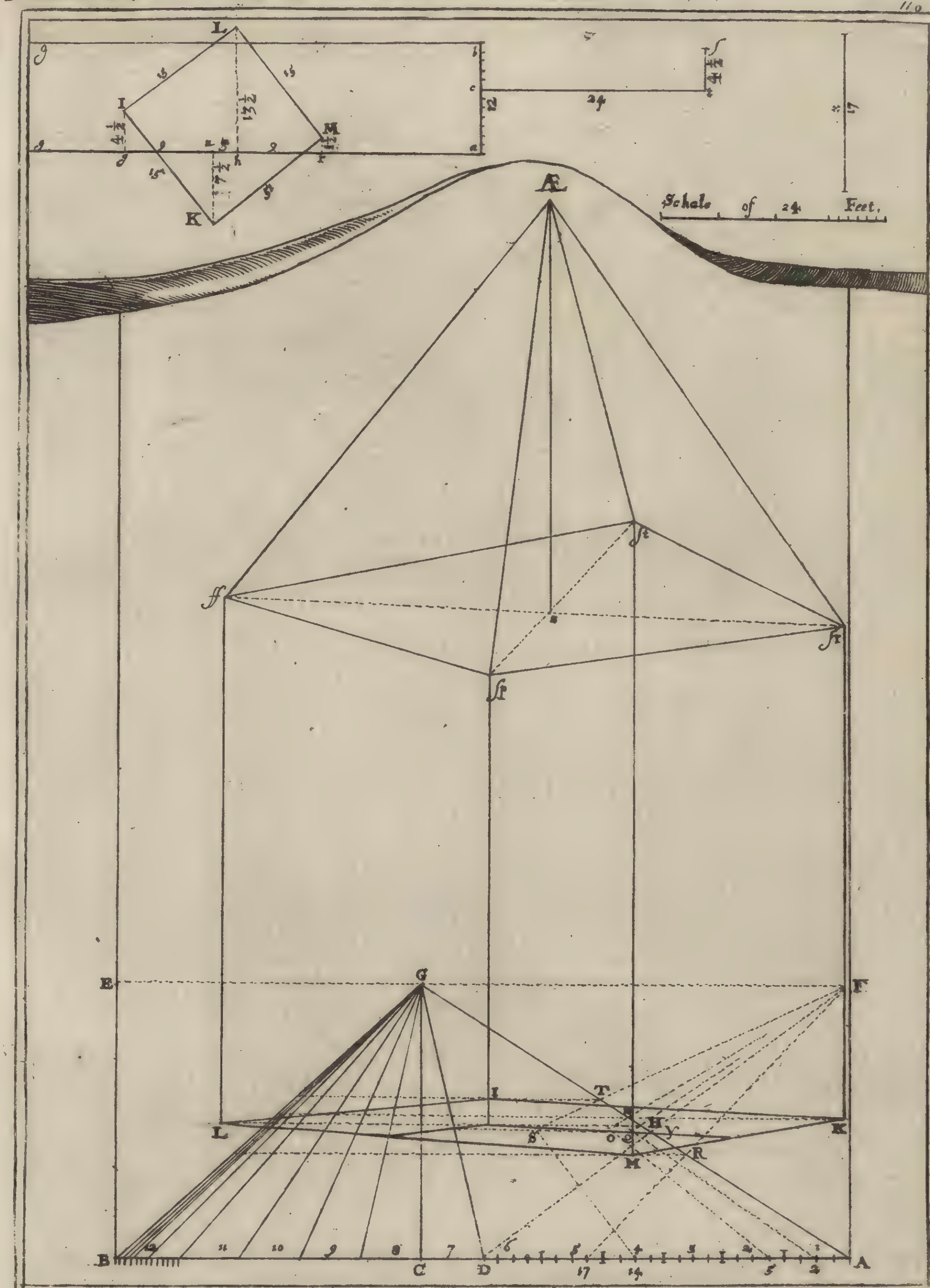
By the scale of distances, the points of the plan are found, and by the scale of measures the lengths of the lines both of the plan and elevation.

Now to put the plan in perspective, all the measures of the geometrical plan must be observed. The first angle of the plan *r m* is 17 feet distant from the point *a*, on the line *a g*. For this reason we reckon 17 parts, beginning at A, and from the seventeenth draw a line to the point F, cutting the ray A G in R. From this point R, a parallel to the base must be drawn: and by reason the point *m* is within the ray *a g*, by a foot and an half, therefore, on the side B D of the line R, must a division and an half be taken, and set off within the ray A G, which will give the point M, representing the angle of the plan *m*. As to the angle *l*, which is 26 feet distant from the point *a*, a line must be drawn from the point D, which is 26 feet from A, to the point F; and where the ray A G is intersected thereby, namely, in the point *y*, a parallel is to be drawn. Now as the point *y* is not remote enough by 2 feet, a line must be drawn from the second division of the scale to the point G, and where this ray cuts the parallel *y*, namely in the point Q, the line Q F to be drawn, which will give the point H on the line A G: from which point H a parallel to A B must be drawn, and on the side B D of the same line H, must the divisions for 14 feet and an half be taken, namely, from the point H to L.

For the point *k*, which is 29 feet distant from A, a line must be drawn from the fifth part of the scale A D, to the point G, and where this ray intersects the parallel *y*, namely in the point O, the line O F must be drawn, which gives the point N on the line A G. Then from N draw a parallel, the side whereof B D, 7 feet and an half, must be taken, to be set off without the ray A G, namely, from N to K.

For the point *i*, which is 38 feet from *a*, take 14 divisions on the scale A D, and from the fourteenth draw a ray to the point G, which cutting the parallel in the point S; from that point draw a line to F, cutting the ray A G in T, which is 38 feet from the point A, inasmuch as the parallel *y* is 24; to which, 14 being added, gives the whole 38. And since the angle *i* is 4 feet and an half within the ray A G, that extent must be set on the side D B of the parallel T, namely, from T to I.

To form the plan, those four points M L K I must be connected by right lines, and perpendiculars erected from their angles, as M *ſt*, L *ſſ*, K *ſr*, and I *ſp*; each of which will be seventeen feet, as is expressed in the plan of the line X. Then, from the extremes of these perpendiculars, draw two diagonals *ſt*, *ſp* and *ſſ*, *ſr*, which intersecting in Z, from the same point Z erect a perpendicular Z Æ, thirteen feet and an half. Lastly, drawing lines from all the four angles *ſt*, *ſſ*, *ſp* and *ſr*, to the point Æ, the cage will be formed in perspective. If you would have it sunk a foot under ground, add a foot underneath each point of the plan, and connect them by lines.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To give any precise distance required, without removing the point of sight out of the piece.

SUCH as are disposed to make use of this universal manner ought to know, that the number of feet you take on the base line are to have a regard to the point of distance proposed.

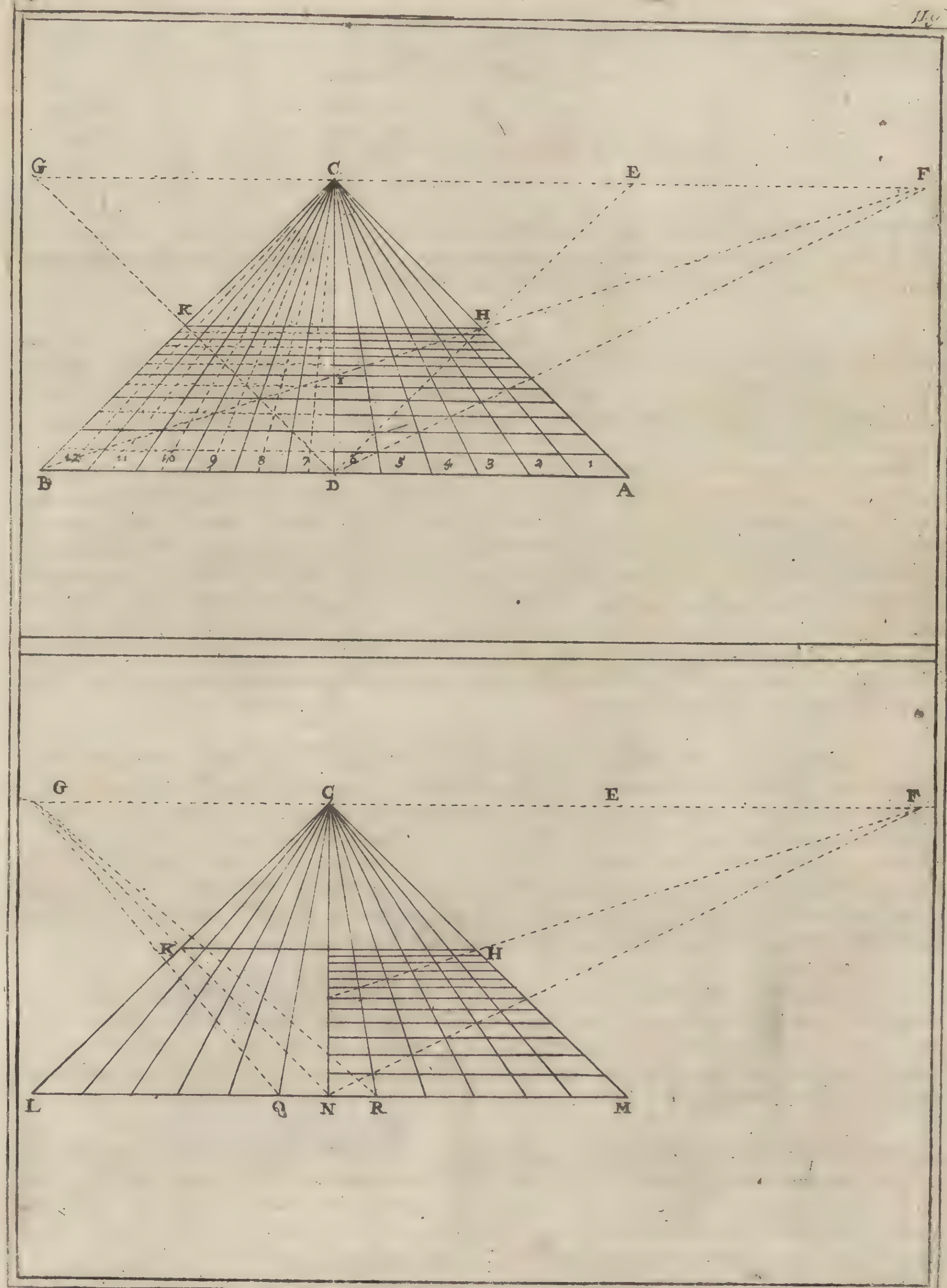
To make the proposition understood: in the first figures are put two points of distance, the one six, the other twelve feet, which have an easy ratio to each other; inasmuch as the six parts being each divided into two, you have twelve.

Suppose then the line A B divided into twelve parts, and from each division lines drawn to the point of sight C; take half these divisions A D, and from D to the point E, which is the distance of six feet, draw D E. It is certain its intersection with the ray A C will give the diminution of the squares viewed at six feet distance. And if from D a line be drawn to F, which is the distance of twelve feet, the line D F cutting the ray A C will give the diminution of six squares, viewed at twelve feet. And if the diminution of twelve squares, viewed at twelve feet distance, were required, from the point B, which is the whole base line, a line must be drawn to F, and its intersection with the ray A C, in the point H, will give the thing required. Or from I a line I F is to be drawn, which will give the same point H, the line H K, in each case, being the depth of twelve squares, viewed at twelve feet distance. Hence we observe, that twelve squares, viewed at twelve feet distance, meet in the same line H K with six squares viewed six feet off, and that all the lines of the six squares, given by the intersection of the diagonal D G, have a relation two by two to those given by the diagonal D F. The reason why the diagonal D F gives two lines for one of those D G, is, that the distance is double. If it were triple, it would give three, and four if quadruple. Now, to find the same intersections, and the same number of squares on the side B D, as are on that A D, without having the point of distance out of the piece, you have only to divide each of the six equal parts between B and D into two, by which means you will have twelve parts: then draw occult lines from each division to the point of sight C, and drawing parallels to the base line through all the intersections the diagonals make with all those rays, you will have twelve squares depth in the same line as if the distance were twelve feet, though in reality G be but six. The reason is, that in multiplying the rays you multiply the squares, and multiplying the squares you remove the distance farther. Such is the reason why having made twelve parts of the six that were between B D, there are procured twelve squares, which have the same depth as if at twelve feet distance. And if a distance of twenty four feet were required, you have only to divide each of the parts between B and D into two, which making twenty four parts, from the twenty fourth draw a line to the point D, and the point K, wherein it intersects the ray B C, will be the depth of twenty-four feet.

In the second figure the same measures are laid down on the line L M, as on A B of the first figure, and the same depth and distance on the side M N, as on the side A D, which gives the line H K; to shew, that if a line were drawn from the fifth part, as Q G, or from the seventh, as R G, the true depth would not be had, which is at K. For R G would not sink it enough, and Q G would sink too much; even though those five or seven parts there were made twelve or twenty-four.

For this reason you are always to observe to take a number which may be multiplied by the distance, as here the distance of 6 may serve for 12, 18, 24, 30, 36, 42, 48, *&c.* the distance 5 may serve for 10, 15, 20, 25, 30, *&c.* and the distance 8 for 16, 24, 32, 40, 48, *&c.* In this way you cannot fail; for supposing the point of distance cannot be nearer the point of sight than G is to C, it follows, that if G be six, seven, eight, or ten feet from C, that then half the base line will have the same number, which is to be divided proportionally to the distance intended. For instance, if there be eight feet from N to L, and I require a distance of thirty two feet, without moving G out of its place; I divide each of the eight parts, or halves of the base lines, as L N, into four, accordingly, four times eight makes thirty-two rays. So that the diminutions of the squares will be thirty two feet distant.

These little divisions do none of them remain after the painting is finished, only the principal divisions of feet, which are drawn to the point of sight, and the diminutions, that is, the parallels to the base line, which still stand.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A very curious Method of drawing all Perfpectives *in the moft natural Manner, without obferving the rules.*

HAVING given you all the neceffary rules for drawing perfpectives in the exacteft manner, I have thought fit to add this and the following method of drawing very correctly after nature, without being tied to the procefs of any one rule.

Many lovers of painting, and who entertain themfelves in drawing after nature, would willingly be excufed the trouble of opening the compaffes, or taking up the ruler, and in this method neither the one nor the other are required; and yet the proportions and diftances of objects will be exactly preferved.

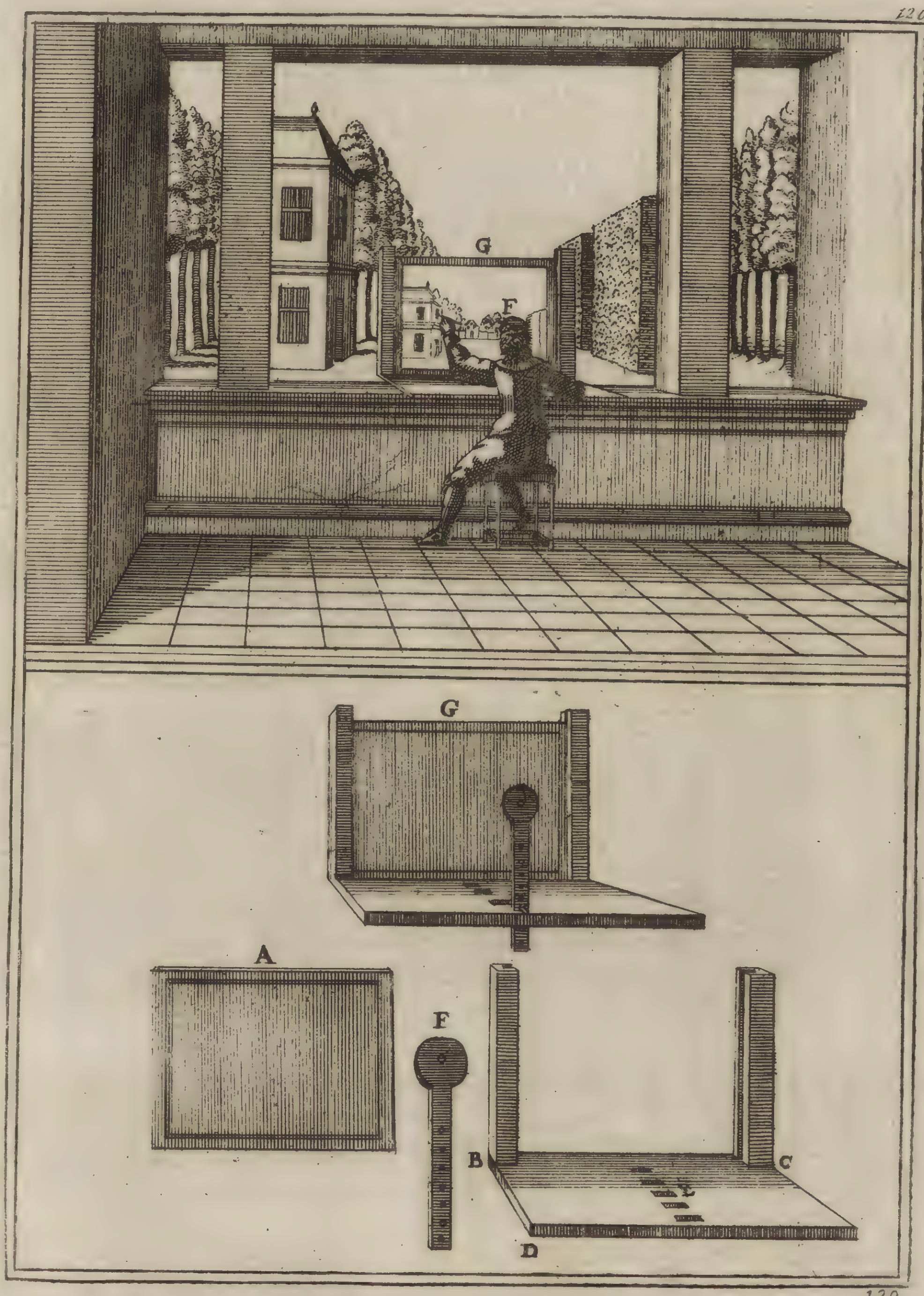
Before I come to the method of performance, I muft defcribe the inftrument ufed therein. The principal requifite is a large piece of fine clear glafs, fitted in a wooden frame, expreffed at the bottom of the plate by the letter A. This frame is to flide between two cheeks or pieces of wood an inch and a half thick, which are raifed at the two extremes of a board the breadth of the frame, that is, about a foot broad, as fhewn in B C, the cheeks are groved to receive the frame A. In the middle of the board fquare holes muft be made as in E, to receive the flit ruler F, fo as it may be raifed or lowered at pleafure. At the top of which ruler is a circle of three or four inches diameter, but very thin, being made of tin, or the like, and having a little aperture about the fize of a pea in the middle. The whole is reprefented put together in G.

The figure of the inftrument fhews the application, yet I fhall defcribe the method of proceeding. Place the inftrument G before the object you would draw, look through the little hole or fight F, and if you fee all the propofed objects reprefented on the glafs, the inftrument is rightly fixed, otherwife bring the fight nearear the glafs, till you fee the whole of what is required. The piece thus rectified, draw on the glafs every thing that you fee thereon through the hole F; which has the fame effect here, as the point of fight in the other methods. And it is certain, every thing thus drawn on the glafs, the eye being fixed to the little hole, will be according to the ftrict rules of perfpective.

It is well known how to take off or copy what is thus defigned on the glafs. One method is to draw on the glafs with pen and ink, then wetting the backfide of the glafs a little, and laying a moift fheet of paper on the fide that has the defign, rub or prefs the paper gently thereon with the hand, and the whole draught will be impreffed or transferred from the glafs upon the paper.

Some advife to make ufe of a hair pencil and colours, but every body is left to his own difcretion. It is enough to know the method in general. The draught of a palace is as eafily taken this way as a landfkip, and a church as a houfe or chamber. All required in any of them being to pitch on a fituation where the whole object intended to be reprefented, may be feen, and to bring the fight to a proper nearnefs to the glafs.

A painter may ufe the fame method for the drawing of figures or poftures, from nature, ftatues, relievo's, and every thing elfe. It being certain, that a little practice will render the method exceeding eafy.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Another curious Manner of practiſing Perſpective, without underſtanding the Rules.

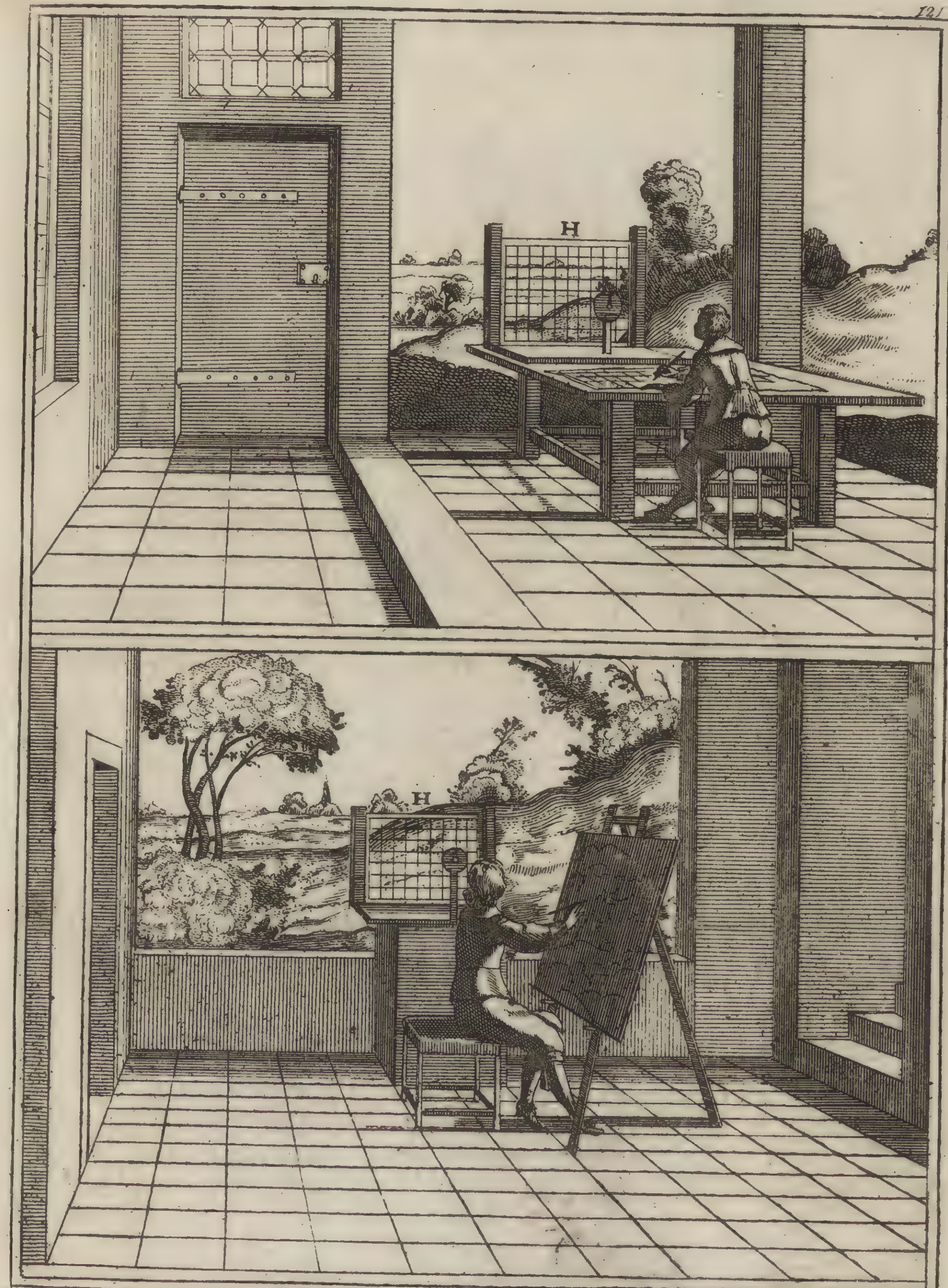
THIS method is as curious as the former, and ſome even prefer it, becauſe a double draught is required in that, one on the glaſs, and a ſecond copied or imprinted from it. Whereas in the preſent method only a ſingle draught is made, and that as exactly as the former.

I ſhall not deſcribe the ſtructure of this inſtrument, it being the ſame with that already mentioned; excepting that the frame, inſtead of a glaſs fitted in it, muſt be divided into a number of little ſquares by fine threads, drawn at equal diſtances from each ſide of the frame, acroſs each other, forming what we call a *reticula* or lettice. As to the number of ſquares, it is left to diſcretion. But they muſt not be too large that you may work the more exactly, nor too ſmall for fear of being confuſed.

For the practice, place the inſtrument H in ſuch manner as that you may ſee all the objects you intend to draw, through the hole of the ſight I. If your draught is to be larger than the compaſs of the frame or *reticula*, ſquares muſt be made on the cloth or paper, larger than thoſe of the frame. If your drawing be intended ſmaller than the frame, make the ſquares leſs. But in all caſes make the ſame number of ſquares on your paper or cloth, as you ſee in the frame when you look through the ſight I. Then, transferring proportionally from the ſquares in the one, to the correſponding ſquares in the other, the perſpective will be as juſt as if you had gone by the ſtrict rules, and uſed the compaſs and ruler.

The two figures ſhew how the inſtrument H is to be placed, in order to draw on a table. The expedient is of excellent uſe in painting, and ſerves to draw very exactly any perſpective from nature, or to copy from paintings.

Some people will be apt to urge, that the method is not new; there being few painters but what know how to enlarge or diminiſh paintings by means of the chequer, or ſquares. All this I allow, but muſt take the liberty to ſay, that I do not know of any that ever yet uſed the ſight-hole, which, however, is of very great advantage to the artiſt.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MEASURES

AND

PROPORTIONS

OF

FIGURES

FOR

Perſpective DRAUGHTS, PAINTINGS, and RELIEVOS.

PART IV.

Figures in perſpective.

HAVING ſhewn how to draw all kind of views in perſpective, I proceed to give directions for adjuſting the height of figures.

I would here make one obſervation concerning the altitudes of figures. Thoſe which are placed at the end of a gallery, hall, or in a garden at the termination of a walk, with a deſign to deceive the eye, and appear at a diſtance to be real life, are beſt repreſented in attitudes which do not ſuppoſe a progreſſive motion. Whereas thoſe figures which are introduced as part of the compoſition of a picture, admit of every kind of attitude to the deſign of the piece.

The number of horizons which our painters frequently introduce in the ſame piece, leads them into innumerable faults, in not being able to give the figures their proper heights, proportionate to their horizons. I ſhall therefore here give a ſingle rule, which may prevent their failing, be the horizon what it will.

For Figures that have the Eye in the Horizon.

IN perſpective draughts placed at the end of a gallery, hall, or walk, to deceive the eye the horizon ſhould always be its natural height, that is, five feet, which is that of an ordinary ſize.

And figures intended to appear there the ſize of life muſt have the eye in the horizon. For, having the eyes in the ſame horizon with ourſelves, they will be of our own height. This might paſs as ſufficient inſtruction; but to make the point more clear and obvious, I ſhall inſtance in theſe three figures, inſtead of twenty others which might be brought.

The firſt figure A is the natural height, and has its eye in the horizon. If a ſecond figure be required in the place B, from the point B a perpendicular muſt be raiſed to the horizon, and it will appear of the ſame height with the former. If you require a third at C, let his eye likewiſe be in the horizon, and he will be the ſame height with the reſt, in appearance. In effect, though there were a thouſand, there need no other rule be regarded, when the horizon is the natural height. I muſt not here be underſtood as including children, which are to be made in proportion to the large figures, according to the diſcretion of the painter.

For Figures that have a low Horizon.

IN painting for halls, which are uſually hung pretty high, the horizon muſt be lower, to bring it as near the eye as poſſible.

Now, to give each figure its juſt height and proportion in whatever part of the painting it be, ſome one muſt be drawn of any height at pleaſure, in any part of the piece, as the figure D F, which is here to do the office of a line of elevation.

And to find the height of the other figures in the painting which are to appear as high as the firſt, draw lines from the head and feet of this figure D F, to a point in the intended horizon, as E, and within this triangle D E F, will be found the heights of all the reſt. Thus, for example, if the height of a figure in the point G be required, from that point G draw a parallel to the baſe G H, till it interſects the line or ray F E in the point H, and the perpendicular H I gives the height of the figure, which is to be taken in the compaſſes, and ſet off in the point G. If another be required in the point K, the ſame operation is to be repeated, and we ſhall have the perpendicular M N for the juſt height. And ſo of whatever number of figures you pleaſe.

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To exhibit Figures *that have a high Horizon.*

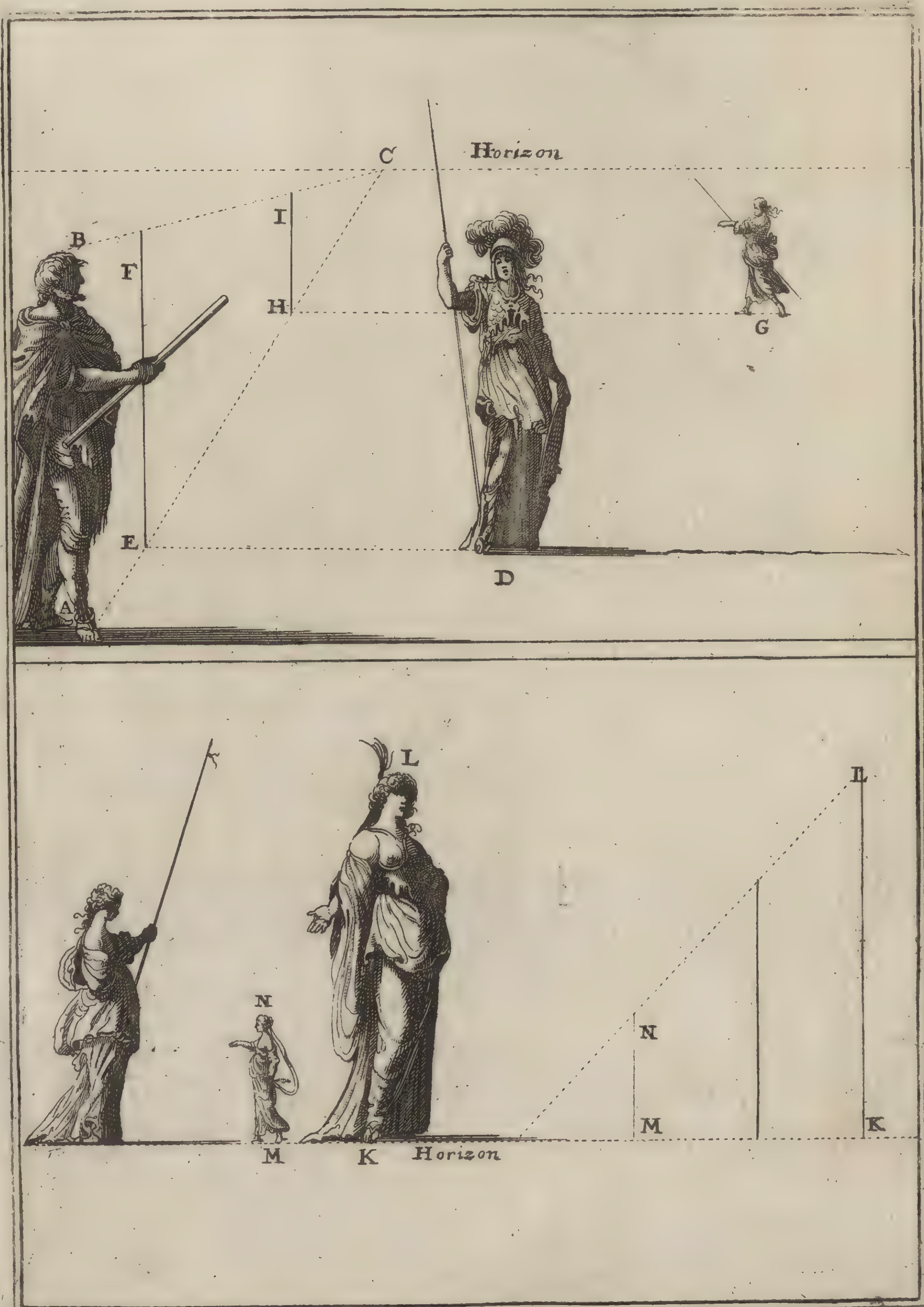
WHEN the horizon is high, as it neceſſarily is when objects are viewed from an eminence, the ſame rule already laid down for the remote figures in a low horizon, muſt be obſerved; as in that caſe, the hindermoſt figures are placed higheſt, and are moſt diminiſhed, ſo in the preſent caſe, their diſtance is expreſſed by raiſing them further off from the baſe line, and diminiſhing them in proportion to their diſtance.

Having drawn the firſt figure AB, draw a line from the top of its head, and another from the bottom of its feet to ſome point in the horizon, as the point C, then will all the heights of the other figures be taken within this triangle A CB. For example, if you would have the height of the figure in the point D, from D draw a parallel to the baſe line, D E, as far as the ray A C, which will give the point E, from which a perpendicular is to be raiſed as far as the line B C, which will give the point F. This perpendicular, E F, will be the height of a figure in the point D. If a figure be required in the point G, the ſame is to be done as for D, and you will have the perpendicular H I, for the height of the figure G. By the ſame method the heights of all other figures in any other places may be taken.

For Figures *that have their feet in the horizon.*

IT is but rare that figures are made above the horizon, but where there is a neceſſity for it, thoſe intended to appear the foremoſt muſt be made the largeſt; that is, they muſt be made the natural height, and all the reſt being made leſs, as they are more remote, will appear equal to them. Thus the figure K L is here the biggeſt and the neareſt, and M N the remoteſt. All the ſecret here, is the painter's finiſhing the front figures more than thoſe behind, and ſtill the farther off they are, the fainter and leſs perfect muſt they be.

The rule for theſe figures, and for thoſe which have their eyes in the horizon, is no other than reducing their height, and making them ſmaller and fainter, as they are thrown farther behind.


C
Horizon
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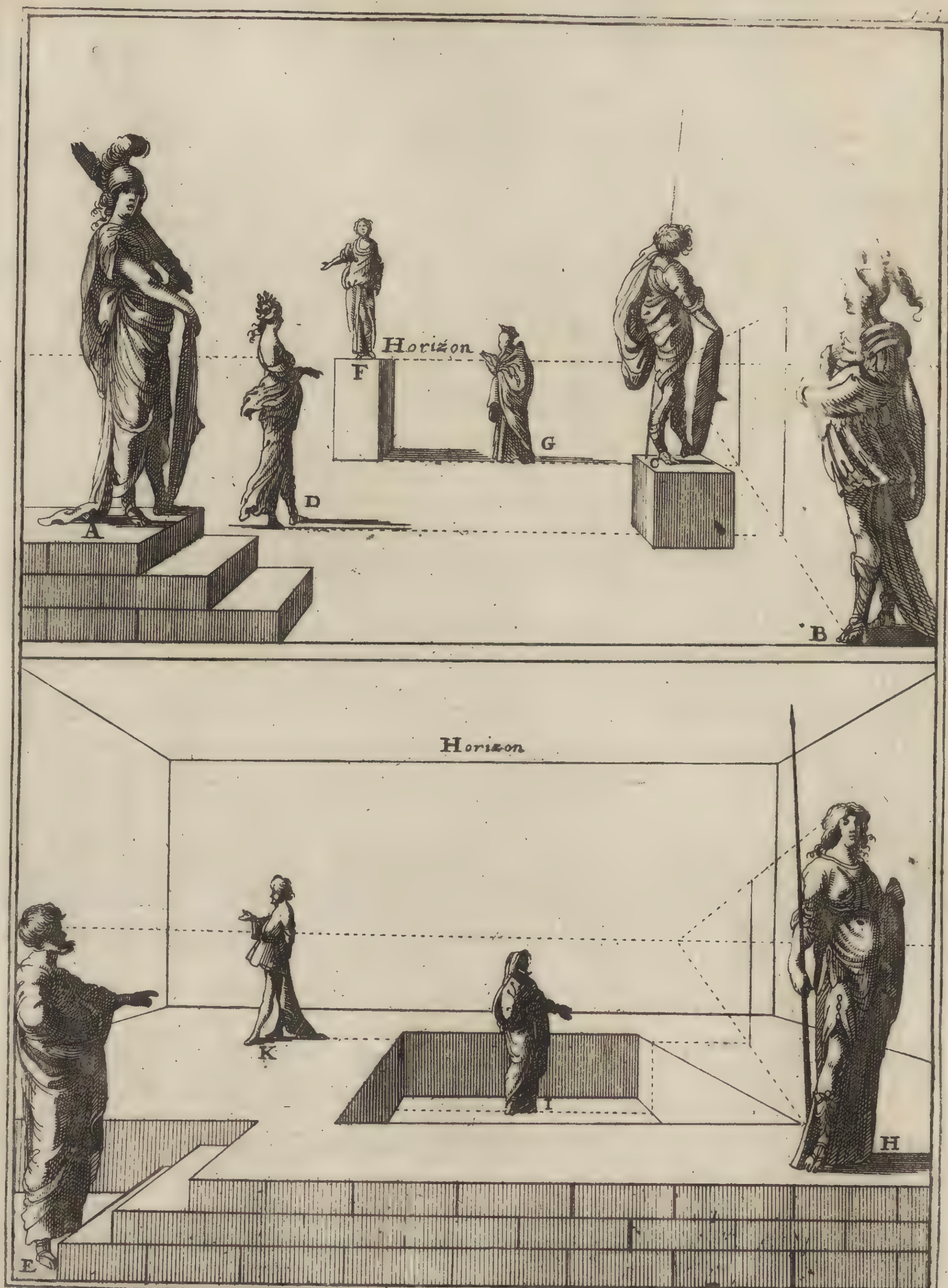
K
K
Horizon

To exhibit Figures *raiſed a ſmall Matter above the Plan.*

THERE are ſome who plead, that objects raiſed above the ground are more diminiſhed than if they were on the plan; and, of conſequence, a figure mounted four or five feet ſhould therefore be ſmaller than if placed on the earth. The rule is good for figures at a great height, as ſhall be ſhewn in its place: but an elevation ſo ſmall as that juſt mentioned, can only make an inſenſible diminution. For ſuppoſing ſuch an object or figure may be ſeen at one ſingle view, that is, without raiſing the eye, it muſt be the ſame height when ſo inconſiderably raiſed, as when ſtanding on the level ground. Thus, the figure A muſt be the ſame height as B, and the figure C as D, and F equal to G.

The ſame reaſon holds for figures a little below the plan, which are to be repreſented of the ſame height as thoſe above it, as as ſhewn in figure E, which is equal in height with H; and I is as big as K. Theſe two examples may ſerve for all caſes, where the variation of the figures is as ſmall as in theſe inſtances, the diminution of figures occaſioned by high elevations will be the ſubject of future inſtructions.


Horizon
A
D
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C
B
Horizon
K
I
H
E

The Poftures *of Figures in Perfpective.*

THERE muft be a judicious choice in the poftures, or attitudes of figures, when intended to deceive the eye. For all of them are not proper, as I have already obferved. This confideration has determined me to add a few, which may pave the way for the invention of numerous others.

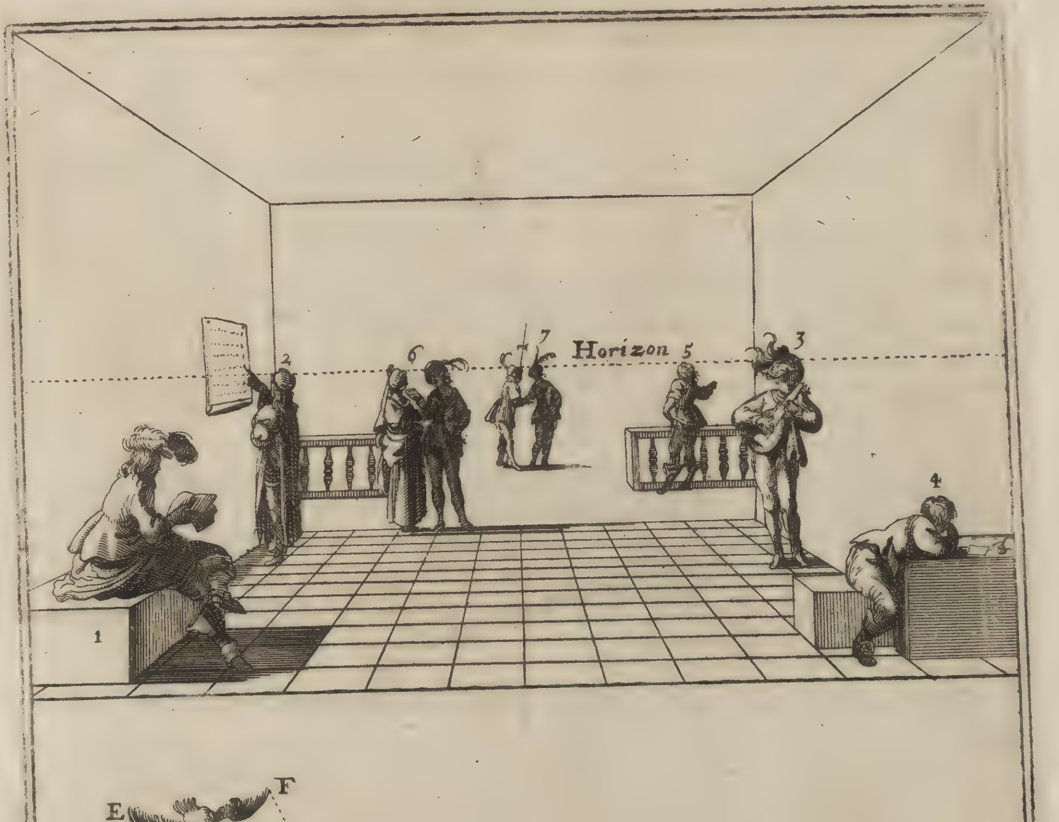
The firft is a man who reads, fitting; the fecond is reading an advertifement pofted on the wall; the third plays on a lute; the fourth is afleep; the fifth is lolling againft the banifters; the group of two figures marked 6, are looking on a draught on paper; the remoter, marked 7, are in earneft difcourfe. One might add others, playing, fpeaking, or difcourfing at table, writing, praying, *&c.* In effect, you have a choice of numberlefs poftures, provided they be fuch as that a man may continue in them for a time. But never ufe fuch as are much in action; for you can never be deceived in feeing a leg or an arm in the air, or a perfon running without fhifting his place.

BEASTS *and* BIRDS *in Perfpective.*

THE fame rules muft here be obferved as in human figures, giving each the height or breadth of the firft, and from the two ends of this firft meafure drawing lines to the horizon from the meafures of all the reft. For example, having intended the firft horfe, A D, to be the height of that other B, from the line A D draw a line to the horizon C, and from B draw a parallel to the bafe line B K, till fuch time as it cut the line A C, which will give the point K; from which a perpendicular K L being erected, will give the height of the horfe in the point B.

As to birds: from the extremities of their wings F F, you are to draw lines to the horizon, and between thofe lines to take the dimenfions of the reft, which we fuppofe of the fame fize. For example, to have the magnitude of a bird in the point G, draw a parallel to the bafe line G H, till fuch time as it cut the rays E and F, which will give the line H I for the magnitude of the bird G.

When beafts or birds are required, you muft always make choice of fuch as are the ftilleft, or leaft active, as a dog fleeping or gnawing a bone, a cat watching a moufe, a parrot, *&c.*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Horizon
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D
A

To find the Height of remote Figures, whereof the firſt is on a Mountain near the Eye.

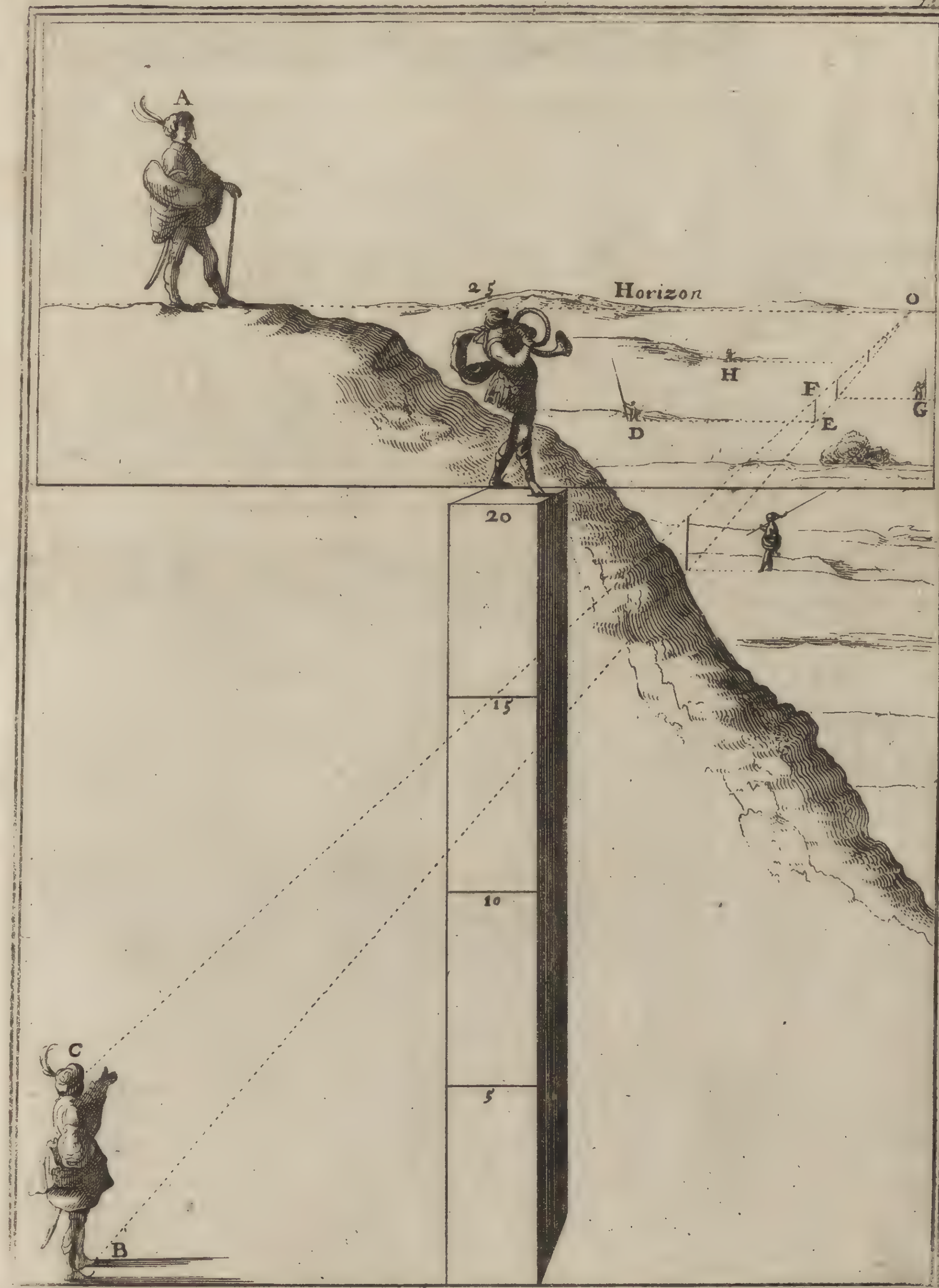
IT gives great ſatisfaction to the mind, when a perſon knows what he does to be right: on which account, no doubt, the reader will be pleaſed to have the following rule, with which but few practitioners are acquainted.

When figures are to be made, determine the hight, that is, the ſpace of the ground you would have it raiſed; and at that diſtance put another figure underneath, of the ſame height as the firſt; and from the feet and head thereof draw lines to the horizon; by which you will have the height of the other figures in the champain. To explain myſelf:

The figure A, for example, which is at the top of a mountain, is five feet high, which is the natural height; and I ſuppoſe the mountain twenty-five feet high: If now a man be raiſed twenty feet, as is the piece in the middle, whereon the ſpectator is mounted (who himſelf is ſuppoſed five feet high) the horizon will be twenty-five feet as well as the mountain; and conſequently will reach the top of the mountain: as is expreſſed in the figure.

Now to find the height of the little people in the champain, make a figure twenty-five feet lower, underneath the figure A, or in ſome other place, as B C; and from the feet B, and the head C, draw lines to ſome place in the horizon, as the point O; and between thoſe two lines, B and C, drawn to O, take the height of the little figures, in the manner already taught. Thus, for the height of the figure D, draw a parallel to the baſe line, till it cut the line B in the point E; from which a perpendicular is to be raiſed, cutting the line C O in the point F: and take the height of this perpendicular E F, for the height of the figure in the point D. If you likewiſe require the height of the figures in the point G and H, proceed after the ſame manner as in the figure D, and you will have their heights between the lines B and C; to be taken in the compaſſes, and ſet off in the points G and H. The ſame you are to do for any other figures, ſtill diminiſhing, till at length you come to a mere point.

This is all I have to ſay as to the meaſures of figures in perſpective. But as I have ingaged myſelf to give all the meaſures of this kind, the following rules come in my way, though they have no ſtrict relation to that art.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Horizon
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To give the natural or any other Height to Figures much elevated.

TO omit nothing relating to the heights of figures, I add the two following rules. The firſt given by *Albert Durer*, *Serlio*, and others, for adjuſting the ſize of letters in inſcriptions ſo as they may appear of the ſame ſize as others below. Which rule may be applied to find the meaſures and magnitude of figures placed at different heights to appear equal when viewed by the ſpectator placed at any height.

Thus in B there is a man five feet high, and fifty diſtant from the tower A, viewing the firſt figure C, which there appears of the natural ſize; and thirty feet higher another figure is to be placed, which ſhall appear of the ſame ſize as the other when viewed from the ſame place. Now, to find its dimenſions deſcribe a quadrant of a circle, or a leſſer arch, on a paper to be placed before the eye; then looking at the figure C, it will give the diſtance or angle, E F, on the paper. This done, without moving the quadrant, look at the point D, where the foot of the figure D I is to be; and obſerve what point it gives in the quadrant, namely G. And from this point G ſet off the ſame diſtance or angle, as that of the figure C, that is to ſay, E F, which being removed to G gives G H. Then looking through the point H, note what part of the perpendicular raiſed from D is cut thereby, namely, the point I; then will the interval D I, be the height required for the figure to be placed there. If you would have another ſtill higher, the ſame operation muſt be repeated, and they will all appear of the natural bigneſs to the ſpectator, B.

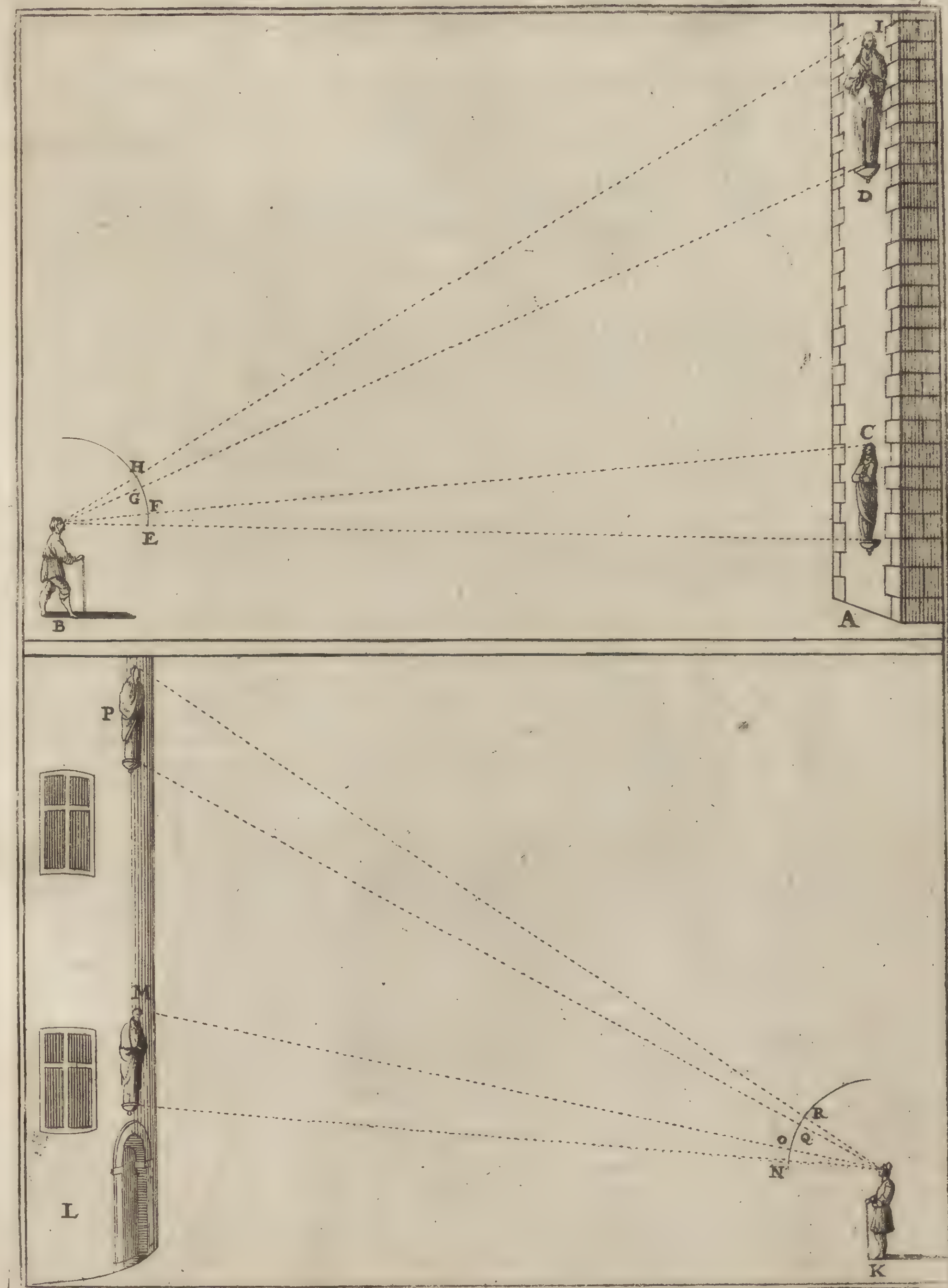
If you require the reaſon thereof, you muſt recollect the principles already laid down, or recur to them again; and you will find that all objects viewed under equal angles appear equal. Now it is certain, that the angle G H is equal to E F; conſequently the figure D I muſt appear equal to the figure C.

To find in what Proportion equal Figures grow leſs to the Eye, when placed over one another.

THE ſpectator K having a quadrant or part of a circle, like that of the former ſpectator B, looks towards the firſt figure M of the tower L; which there appears of the natural ſize. Then taking its meaſure from head to foot he marks the diſtance thereof on the quadrant, namely, N O. After this, without ſtirring out of his place, he directs his eye to the head of figure P, and marks the angle it gives on his quadrant Q R. And if there be others ſtill higher, he ſhould take them all after the ſame manner, and lay them down on his quadrant.

Now to find the difference between the one and the other, take the angles or diſtances of each in your compaſſes, and you will find that the higheſt gives the ſmalleſt angle, and of conſequence appears the ſmalleſt to the eye; the figure P only appears half the ſize of the figure M, though in reality both figures are of equal magnitude. If you aſk the reaſon of this different appearance, I anſwer that the angle of the higheſt figure P, is only half that of the lower figure M; as you ſee that Q R is only half of N O, or nearly ſo.

By the knowledge of this rule we may arrive at that above, and by that above we can come at this. For if M and P be the ſame magnitude, and yet P appear to be only half of M, we may ſecurely ſay, that to make P appear as big as M, it muſt be twice its preſent magnitude. The ſame may be ſaid of the upper figure, where D, which is double to C, appears of the ſame ſize to a ſpectator in B. It might be added, that if the figure C was removed to D it would only appear half as big; ſo that one rule is the reverſe of the other. Both the firſt and ſecond rules are beſt put in practice by the little foot, as the figures hitherto have been; by which we come to the difference and proportion of figures as ſecurely as if they were taken from the life by a quadrant.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Measures for elevated Figures.

FROM what has been said concerning the diminution of figures when placed on high, we are to take our measures in proportion, for such as are to be raised in paintings, whether they be placed on mountains, the tops of houses, or above the clouds in the air. The two rules I shall now give, will render the method extremely easy.

For the first. Suppose the man A to be six feet; which height set off several times on the perpendicular B, and from the several divisions 6, 12, 18, *&c.* draw lines to the head of the figure A. Then setting one leg of the compasses in the point A, with the other describe the arch C D, and the intersections that arch makes with the rays, are the measures to be given the figures at those several heights or perpendiculars B. Thus, if you would have a figure appear forty two feet high; take E D, which cuts the two last rays, and set it off to F, which is forty two feet above the base line A B. If another be required thirty feet high, the distance G H must be taken, which cuts the ray 30, 36, and gives the height of the figure P; and so of the rest. The main point is the approaching or receding of the line B; which must always be the distance between the spectator and the object, namely here, thirty feet, or thereabout.

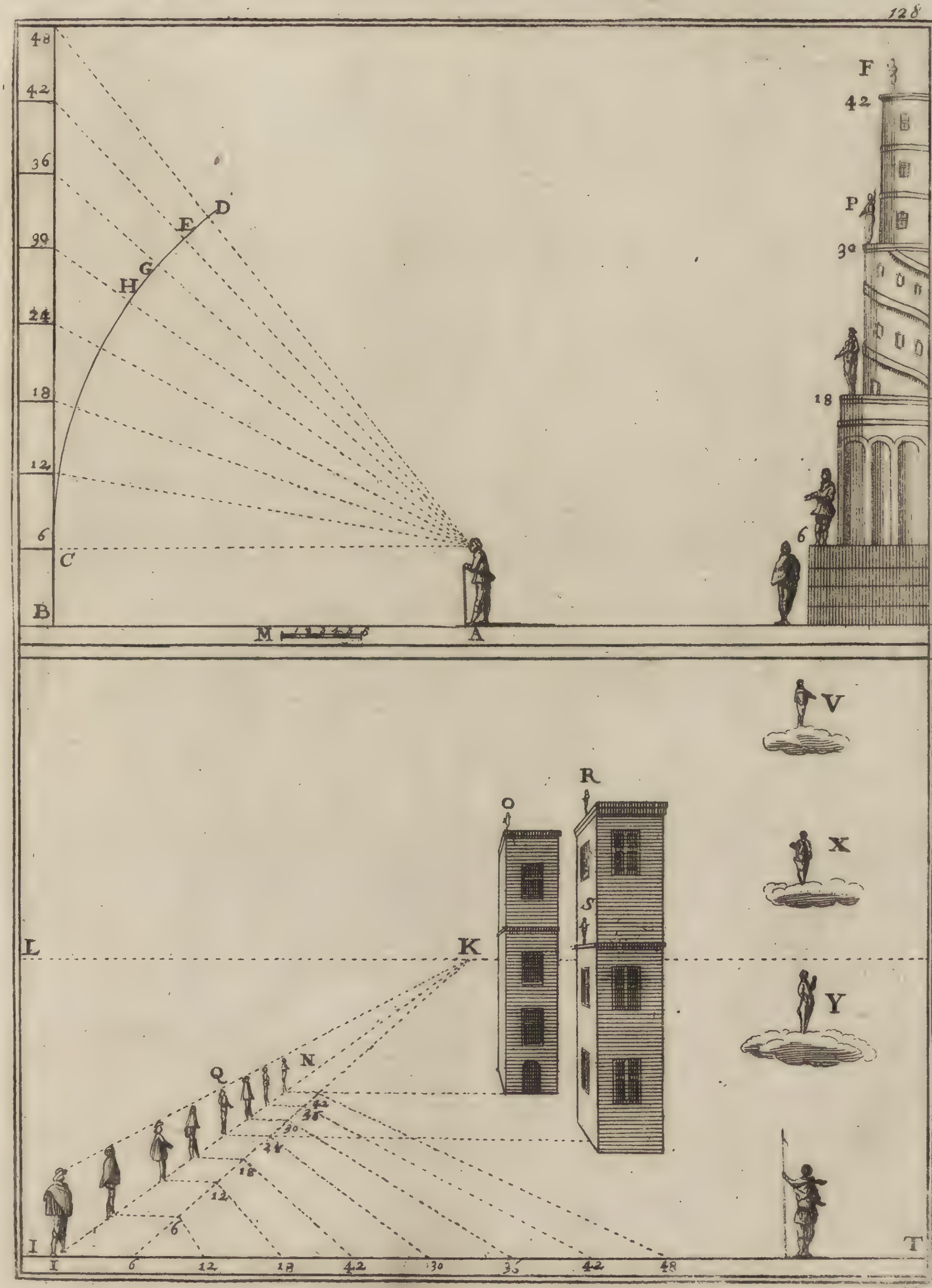
For the second rule. Instead of the perpendicular B used in the first figure, I here put the division from six feet to six on the base line I T. The two first points I and 6 are to be drawn to the point of sight K. Thus between the two rays I K, and 6 K, we have the measures of six feet, which is the height to be given the figures. Then from all the other divisions 12, 18, 24, 30, *&c.* draw lines to the point of distance L, and in the intersections made with the ray 6 K, draw little parallels to the base line, between the rays I K, and 6 K. These parallels will give the heights of figures of equal magnitude, but at different distances. Which may be proved by comparing the measures of the first method with those of the second.

If it be asked how much each figure is diminished from the first, which is six feet high, you need only to take the height of the figure required in your compasses, and set it off on the little scale M, and the question is solved. Thus having taken the height of the figure B, and set it on the scale M, it gives four feet; which shews, that a figure six feet high, raised thirty feet, will only appear to be four feet. The heights or diminutions of the rest are found by the same operation; provided the distance be the same with that of these. If the distance be changed the process must be begun anew.

The figures V, X, Y, placed in the clouds are of the same height and proportion as the figures in the uppermost draught. They are only here added to shew, that though the method be different the effects are the same.

What has been said as to the diminutions of figures elevated over the base line A B in the first method, and I T in the second, must be observed in proportion between those figures which are sunk farther behind. Those of them which are placed on an elevation must have the same relative magnitude according to their heighth with the figure on the ground, on the same line with them, as F and P have to A. Thus, in the second rule, if over-against the last figure N, another figure C, be placed on a tower forty eight feet high, its magnitude must be in the same proportion to N, as the figure at N has to that at I. And inasmuch as the figure at N contains only two and a half of the six parts which I contains, this at O upon the tower must only have two and a half of the six parts in the figure N. If I would have another figure R, on another tower, forty eight feet high opposite the figure Q, I take two parts and a half of the figure Q for the height of the figure. If another were required in S, which is thirty feet high, in the same tower, he must take four of the six parts of the figure Q, that is, four feet; as already mentioned in the first method between the rays G and H.

What renders this rule the more valuable is, that all the proportions of figures may be learnt by heart. For whoever would be at the trouble of making this measure, where he might add more parts, they would serve him in all cases; and he would render them so familiar, that in a little time he would tell you off hand, that if you are thirty-five feet distant, and the figure six feet, or six parts high, when on the ground, another, that shall be of the same size, will only appear five and a half when raised to the height of twelve feet; only five, if raised eighteen feet; only four and a half, if twenty four feet; only four, if thirty; only three, if thirty-six; and only two and a half, if forty-two: and so on, by six and six, to any number at pleasure.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M E T H O D S

Of finding according to the Laws of PERSPECTIVE, the

N A T U R A L S H A D O W S

O F

O B J E C T S

Both by the

SUN, CANDLE, TORCH, and LAMP.

P A R T V.

The Origin of Shadows, *with the Laws of their Projection from opaque Bodies.*

TO *define a natural ſhadow*, we do not call it an abſolute privation of all light, for this would be to form a perfect obſcurity, wherein objects would be no more ſeen than their ſhadows: but by *ſhadow* is meant diminution of light, occaſioned by the interpoſition of ſome opaque body, which receiving and intercepting the light that ſhould be caſt on the plane, gives there its own ſhadow. For the rays of light diverge, and diffuſe themſelves on every thing not hid therefrom, particularly on every plain and ſmooth ſubſtance, but where there happens the leaſt elevation, a ſhadow is produced, which exhibits the figure of the illumined part on the plan.

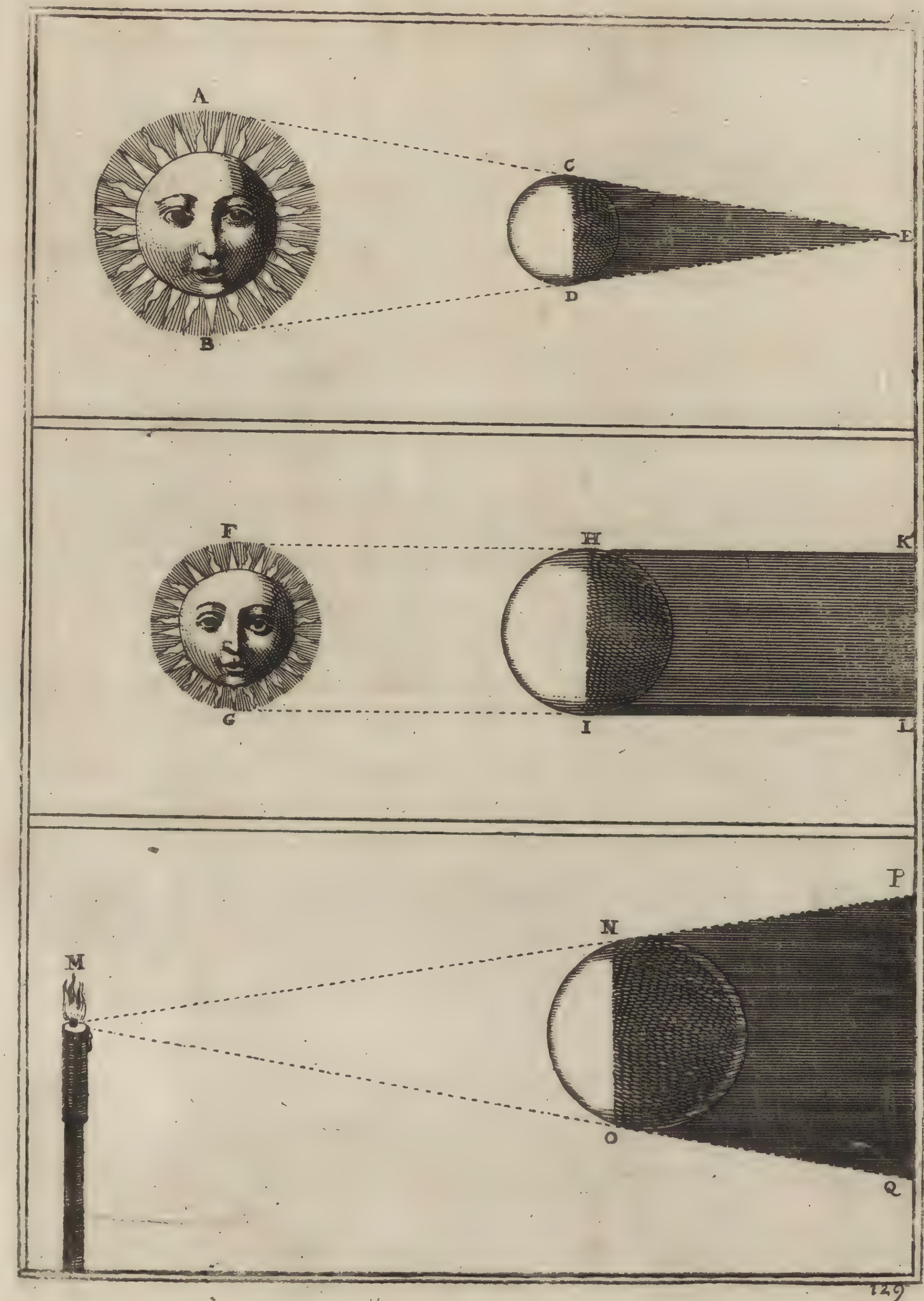
The *diverſity of luminaries* occaſions a difference of ſhadows; for if the body that illumines be larger than the body illumined, the ſhadow will be leſs than the body. If they be equal, the ſhadow will be equal to the illumined, and if the luminary be leſs than the object, the ſhadow will be continually enlarging as it goes farther off.

The better to comprehend this, I here add three figures, which may ſerve as a foundation for all the rules to be advanced hereafter.

The firſt ſhews, that the luminous body A B, being larger than the illumined ſphere C D, enlightens more than half the object, and gives a pointed or conical ſhadow, whereof the luminary is the baſe. This truth is evinced in an eclipſe of the moon, which is rarely quite covered by the ſhadow of the earth, though the latter be above forty times bigger than the former. The reaſon is, that the ſun, which is the luminary, is one hundred times bigger in diameter than the earth, which therefore it illumines more than half, and of conſequence makes its ſhadow terminate in a point.

In the ſecond figure, the luminous body F G is equal to the illumined ſphere H I, therefore half of the object is enlightened, and its ſhadow projected parallel; H I K L, and it will be propagated in that form to whatever diſtance the luminary is capable of acting.

The third figure ſhews, that the luminary or light M, being leſs than the illumined N O, that object is not half enlightened. And of conſequence the ſhadow N O P Q enlarging as it recedes farther from the object, makes a pyramid, whereof the luminary is the point or vertex.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129

Of the Difference of Shadows.

FROM what has been obſerved in the preceding page we draw this concluſion, that the ſame object may project ſhadows of divers forms, though ſtill illumined on the ſame ſide; the ſun giving one form, the torch another, and the day-light no preciſe form at all.

The Sun always makes the ſhadow of breadth equal to the opaque object, that is, projects it parallel-wiſe, as in the firſt figure.

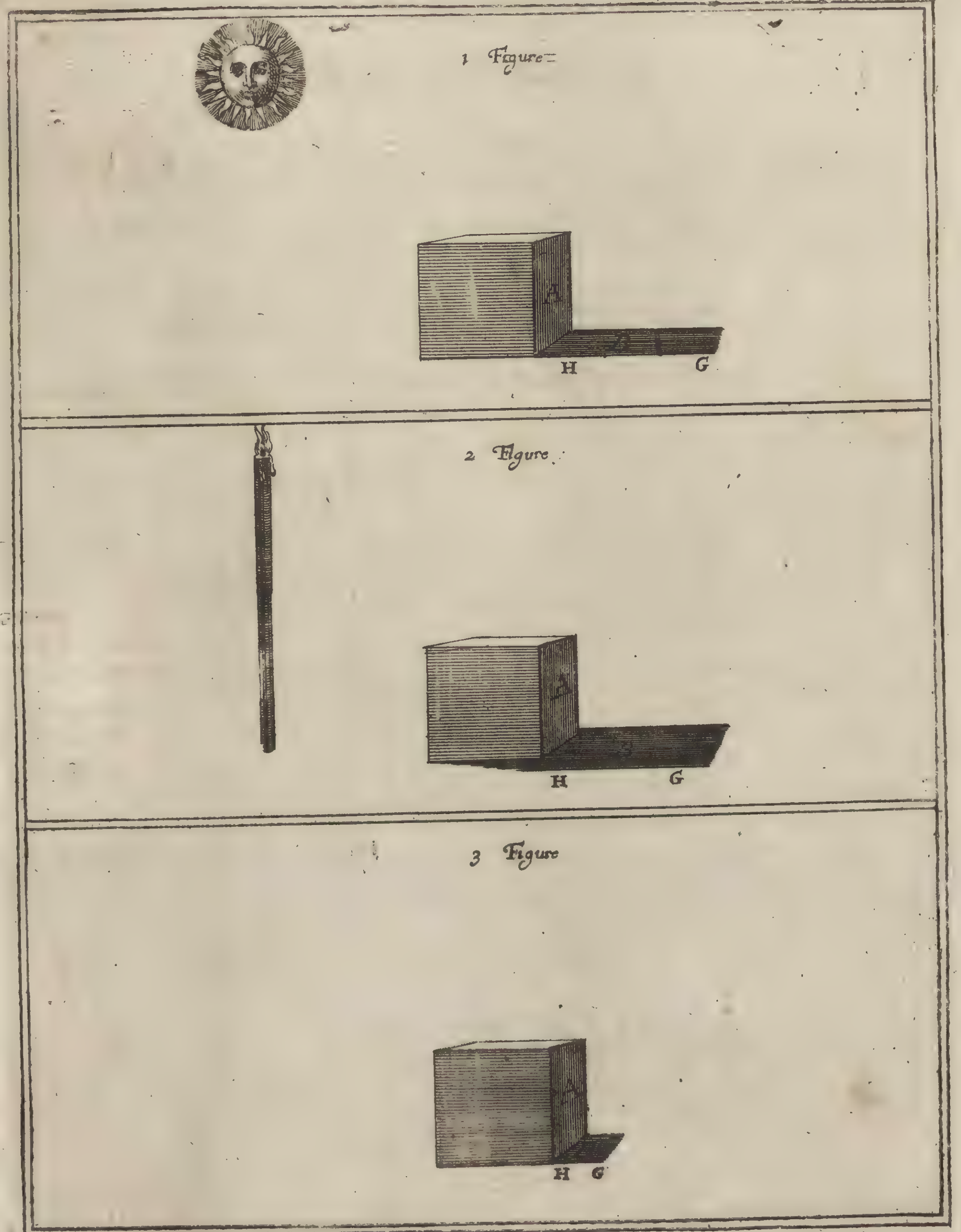
How this method is to be put in practice, and every object have its natural ſhadow, ſhall be ſhewn hereafter. It is certainly of conſequence to all painters, engravers, *&c.* to obſerve theſe rules preciſely, and not indifferently to uſe the ſame method for ſhadows produced by the ſun and by artificial luminaries, as is too frequently done.

The ſhadow produced by a torch or flambeau is not projected in parallels, but in rays proceeding from a center; whence the ſhadow is always bigger than the opaque body, and grows bigger as it recedes the farther. this is ſhewn in the ſecond figure, where the ſhadow is larger than in the firſt, though the cube of the one and the other be of equal breadth and height. It appears, therefore, a groſs abuſe, to repreſent the ſhadow of a torch like that of the ſun, and the ſhadow of the ſun like that of a candle, when the difference is ſo conſiderable.

There is a third kind of ſhadow, neither produced by the ſun nor a torch, but only a fine clear day, which wanting ſtrength to finiſh and define its form occaſions a dimneſs near the object, as in the third figure. Now for this there is no certain rule, but every body conducts it at diſcretion.

All theſe ſhadows, both thoſe of the *ſun*, of the *torch*, and of the *day-light*, muſt appear darker than the parts of objects not illumined. Thus A is leſs dark than B, by reaſon A receives the reflection of the brightneſs around it, and B has no reflection but from A, which itſelf is in obſcurity. It muſt be obſerved by the way, that the part of the ſhadow moſt remote from the object is ſtill darker than that neareſt it; as G is darker than H, by reaſon A cannot communicate the little reflexion it receives, as far as G, though it does to H.

130



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To find the Form of the Shadows.

IT may be remembered, at the entrance of this work, PERSPECTIVE was defined the art of reprefenting objects which are on the ground or horizontal plane, upon a plane perpendicular to the horizon. But in the bufinefs of fhadows it is quite the reverfe, fince we there conceive a body raifed over the plan, which being illumined, cafts its own fhadow on the plan; as the body A gives a fhadow B, on the plan.

To produce a fhadow, two things are fuppofed, namely, light and an opaque body. Light, though quite contrary to fhadow, gives it its being, as the opaque object gives its form and figure. *What we have here to confider is the fhadows, the reader has been already inftructed in what relates to putting the bodies in perfpective.*

To conceive the nature of fhadows more clearly, and render the practice more eafy, it muft be obferved, there are two points to be made ufe of. One of them is the foot of the light, which is always taken on the plan the object is placed upon; the other is the luminary. The rule being common to the fun, torch, or any other light, with this difference, that the fun projects the fhadow in parallels, and the torch in rays, from the fame center. I begin with the fhadow produced by the torch, as leading to a more eafy underftanding of that by the fun.

Suppofe then, for example, it is defired to have the fhadow of the cube A here reprefented in B, lines muft be drawn from O, the foot of the luminary, through all the angles of the plan of the cube, as here O D, O E, O F, O G. Then other lines are to be drawn from the point of the light of the torch C, through all the raifed angles, till they interfect the lines from the point O. Thus having drawn a line from O through the angle D, another muft be drawn from C through the raifed angle, interfecting the former in H, which point H will be the fhadow of that angle. And if from the fame point C, the fame be done through all the raifed angles, the lines of the plan will be cut in the points HIKL, thefe points being connected together by right lines, you will have the fhadow of the cube, as is fhewn in the uppermoft figure of interfection, and more diftinctly in that below.

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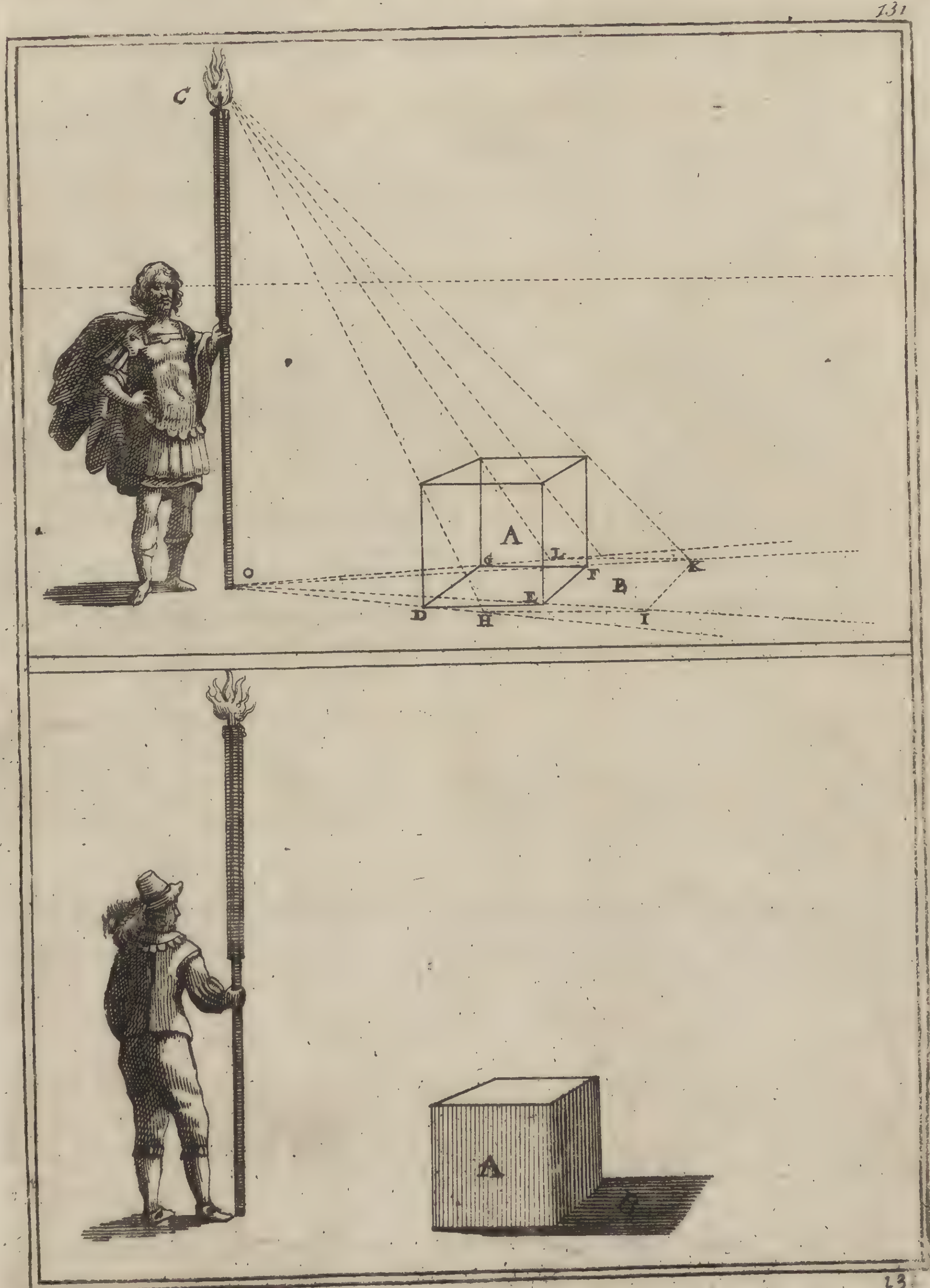
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Shadows *from the* Sun.

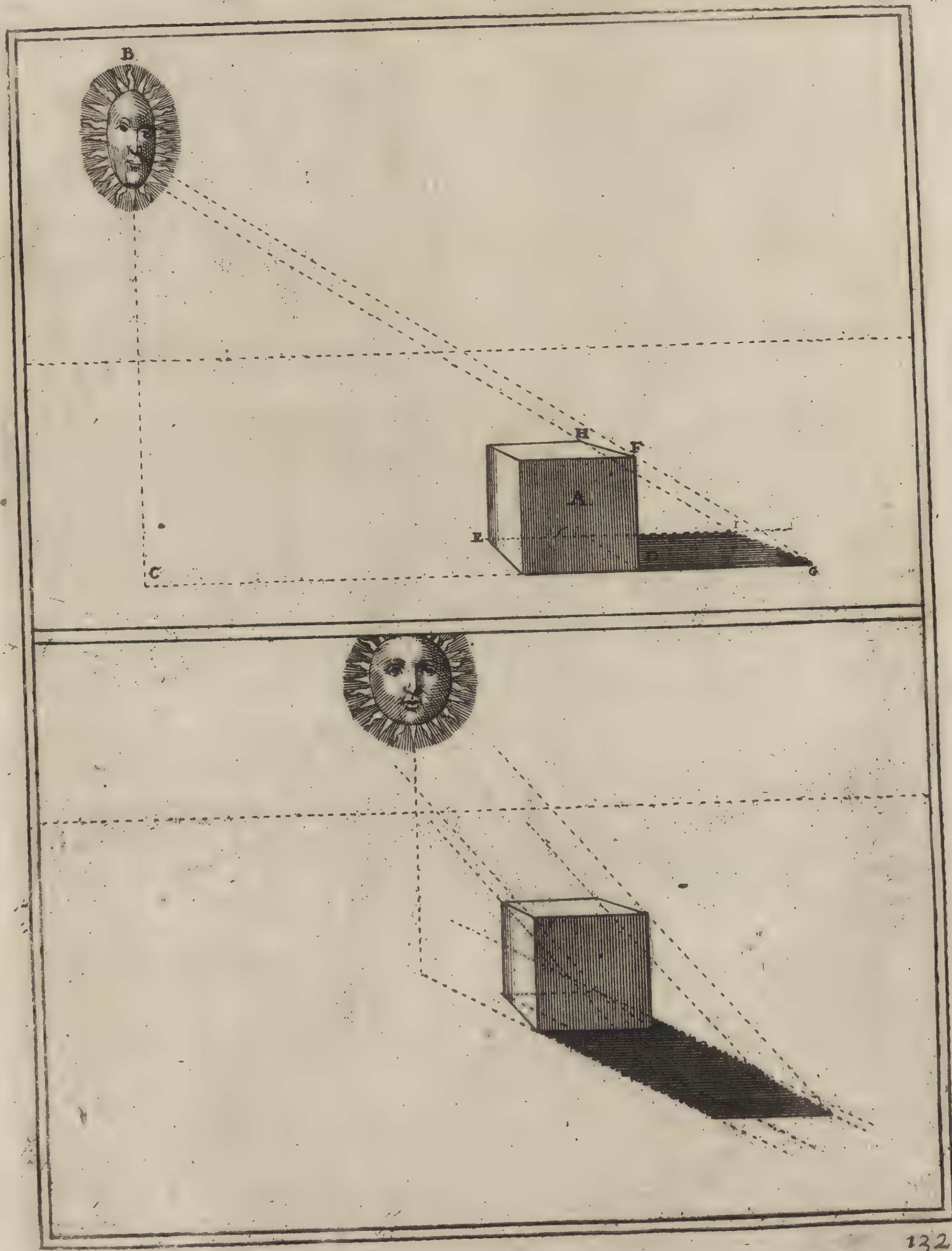
THE ſun, that magnificent luminary, being vaſtly larger than the terreſtrial globe, as has been already intimated, muſt give the ſhadow of that ſphere pointed, by reaſon it always illumines more than half thereof.

In conſequence of this demonſtration we might conclude, that all the ſun's ſhadows muſt be leſs than the bodies that project them, and diminiſh more and more as they recede farther. Now this would be true, were there any conceivable relation of magnitude between the illumined body and the illuminer; but as all objects on the earth are ſo ſmall, either in compariſon of that ſtar or of the earth, the diminution of their ſhadows is imperceptible to the eye, which ſees them always of equal breadth to the body that forms them. On this account all the ſhadows cauſed by the ſun are made in parallels, as is ſhewn in page 130.

From the whole it appears, that to find the ſhadow of any body whatever, oppoſed to the ſun, a line muſt be drawn from that luminary perpendicular to the place where, according to former directions, the foot of the light is to be taken, and from this point an occult line is to be drawn through one of the angles of the plan of the object, and another from the ſun through the raiſed angle; the interſection of the two lines will expreſs how far the ſhadow is to go. The other line muſt be drawn parallel hereto.

For example, to find the ſhadow of the cube A, the ſun being in B. From the bottom of the ſun C, which is, as it were, the foot of the light, draw a line through one of the angles of the plan, as C D. Then from the other angle E, draw a parallel to this line. The breadth of the ſhadow being thus finiſhed, to find the extreme thereof, draw a line from the ſun B, through the raiſed angle F, cutting the line C D in G. Then drawing a parallel to this line through the angle H, it will cut the line E in the point I; theſe two points G and I being connected by a ſtrait line compleats the ſhadow of the cube D G I.

If you deſire to have the ſhadows caſt forward, or any other way, you have only to determine the place of the ſun, and the point beneath it, to draw the lines of the ſame angle, and the other lines parallel thereto. The method is the ſame as in the former caſe, ſo that it needs not be repeated. The figure ſhews the reſt.



132

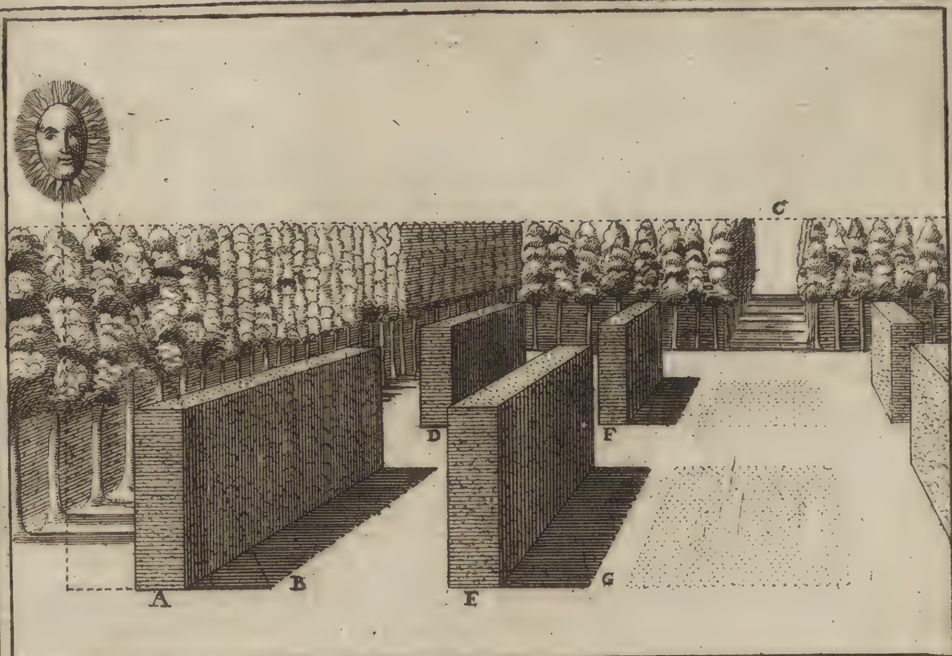
The Shadows *produced by the Sun are equal in all Objects of same Height, though at a Distance from each other.*

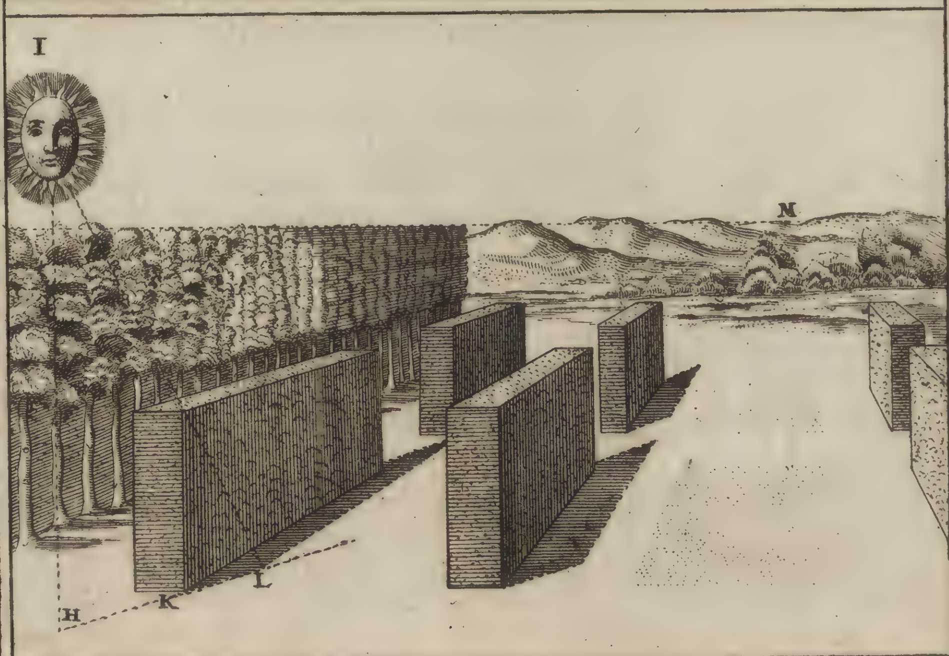
EXPERIENCE teaches us, that several elevations of the same height, removed to a distance from each other, do yet project equal shadows at the same time. I say in the same time, for the shadows are lengthening and shortning, in proportion as the sun comes nearer or recedes farther off; one or other of which he is continually doing.

For this reason, when the shadow of an object is to be produced, you must determine the place of the sun, and the point underneath which I call the foot of the luminary, and draw two occult lines from them, for the extremity of the shadow; as here the palisade A gives the extreme of its shadow in B. And if from this point B, you draw a line to the point of sight C, this line B C will be the shadow of the palisade D, as well as of that of A, and of all others of equal height in the same line to the very point of sight. In effect, it must be held for a certain maxim, that shadows always retain the same point of sight as the objects.

On the footing of this observation, that objects of the same height give equal shadows, if you would give the shadow of the palisades E, F, which are the same height as A, D; take in your compasses the distance A B, and set it on the foot of the palisade E, by which you will have E G; then from G draw a line to the point of sight C. And thus you are to proceed, be the walks ever so numerous.

If the light come from the fore-part, as in the figure underneath, the method must not be altered; but only the foot, or bottom of the sun, is to be brought nearer or farther off according to the sun's place, and lines drawn from the center and foot of the luminary through the upper and lower angles. Thus the lines from H and I give the extreme of the shadow of the palisade K, in the point L; and from L a line drawn to the point of sight M limits the side shadow. From the remote angles of the plan of the palisade, a parallel to the line H drawn as far as the ray L M, will give the extreme end of the shadow, and the whole will appear natural.





133

Of Shadows, *when the Sun is directly oppoſed to the Eye.*

AS often as the ſun is before the eye, that is, directly over the point of ſight, the ſides of the ſhadow it produces will be parallels, as all the viſual rays are. For this reaſon, the point of ſight is always to ſerve for the foot of the light when in that altitude, and the other ray, that is to determine the ſhadow, will be taken from the center of the ſun.

Thus the ſhadow of the cube A being required, draw lines through the angles of its plan B C, to the point of ſight D, as the lines B E and C F. Then, from the center of the ſun G, draw two rays cutting the former in the points K and L, and paſſing through the raiſed angles H and I. By this means the ſhadow of the cube will be found in B K L C.

The ſhadows of the two other objects, M and N, are found by the ſame rule, and ſo might the ſhadow of any object whatever.

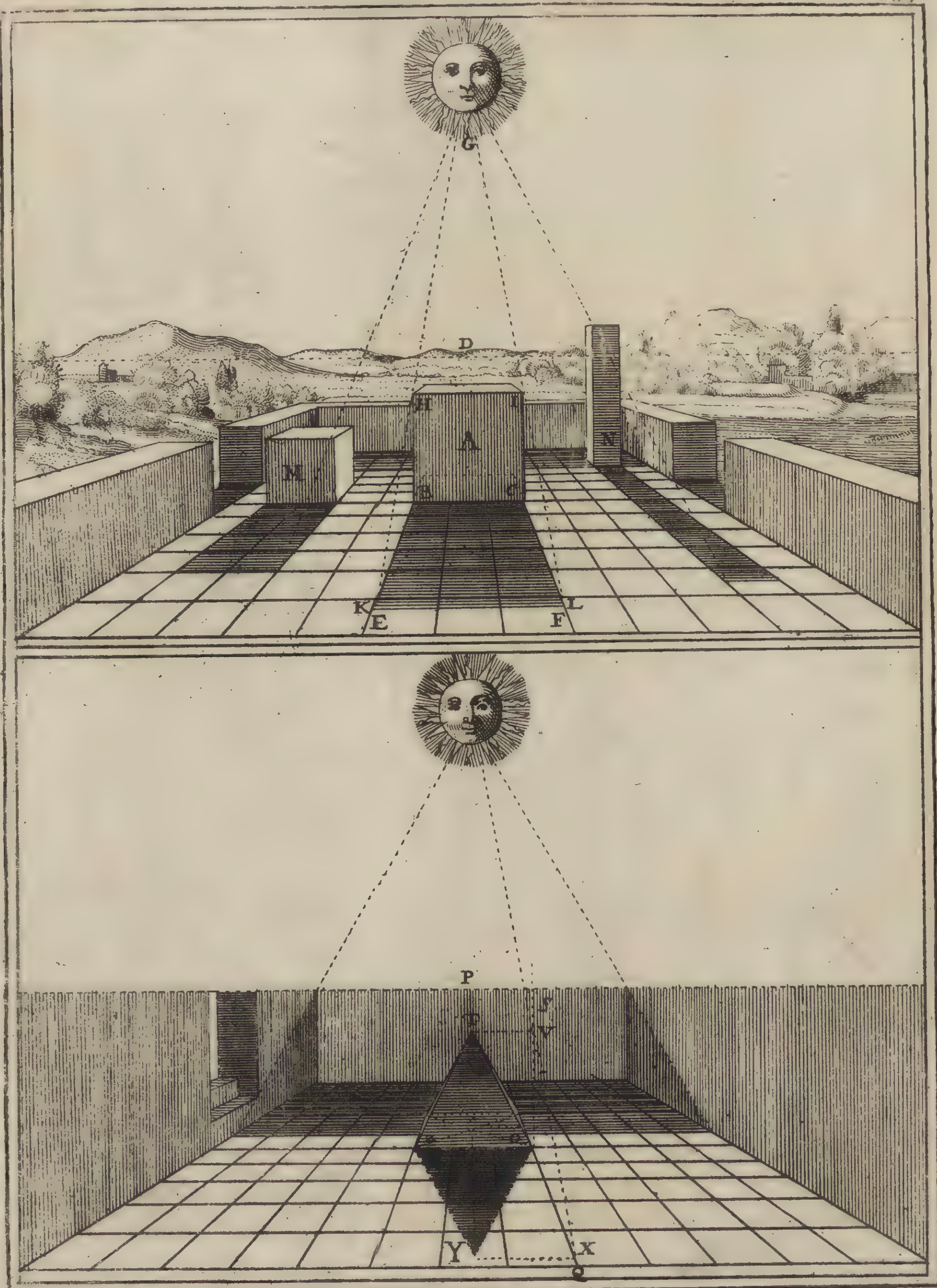
But my mind ſuggeſts, that there might be ſome difficulty, if, inſtead of a cube, a pyramid were given; by reaſon the ray from the middle of the pyramid, and that from the ſun, paſſing through its vertex or point, only make one line; and of conſequence cannot terminate any thing for the ſhadow of the vertex of that pyramid.

When this happens, draw a line from the point of ſight P, through one of the angles of the plan; by which means you will have O Q. Then from O erect a perpendicular O S, and from the point of the pyramid T draw a parallel to the baſe, till it cut the perpendicular O S in the point V. Draw the ray of the ſun through this point, and continue it till it cut the ray O Q in the point X; from X draw a parallel to the baſe, as far as the ray of the middle of the pyramid, which will be cut thereby in the point Y, the extreme of the ſhadow. To Y draw lines from the angles Z and O; and the triangles Z Y O will be the ſhadow of the pyramid.

The like you are to do for the oppoſite face, if it be perpendicular to the plan; and the ſame rule will ſerve in all caſes. For example, if the point, or apex correſpond to the center of the plan, draw a line from the ſame center parallel to the baſe, and of any length at diſcretion; and from the end of the line, as here from O, draw a line to the point of ſight, and proceed as before. Which will be a ſtanding rule, whether the pyramid be viewed in front or ſide-wiſe. And hence you will eaſily judge what is to be done, if the point or vertex correſpond to any other ray of the middle of the plan.

The walls in the front of each figure have their ſhadows as already taught in that of the cube A.

4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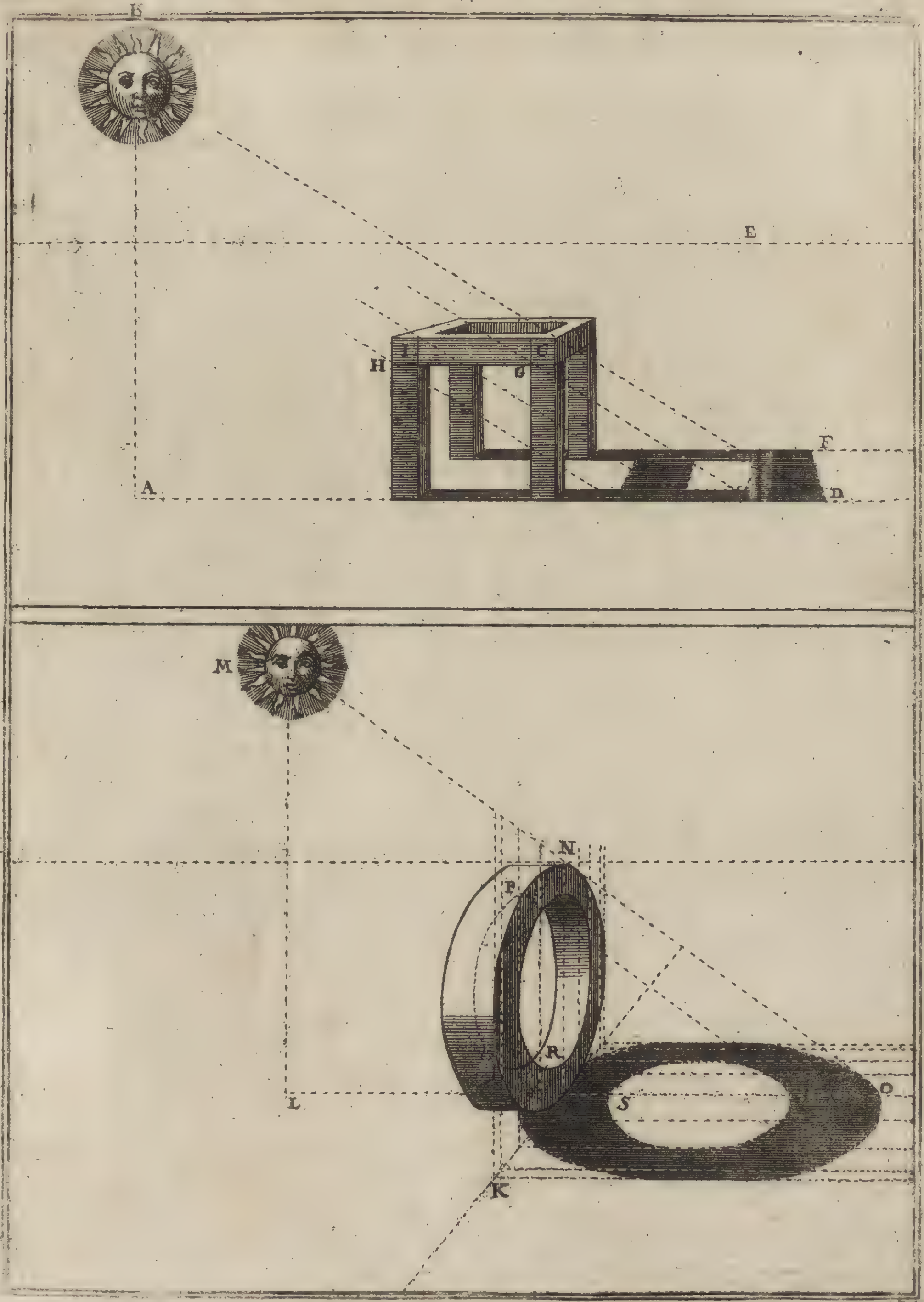
Y
X
Q

For the Shadows *of perforated Objects.*

WHEN the object is ſquare or rectilinear, a line muſt be drawn from the foot of the luminary through the angles of the plan for one ſide of the ſhadow, and parallels thereto for the other ſides; then from the middle of the ſun B, draw a line through the raiſed angle C, which will cut the line from A, in the point D; through which point a line muſt be drawn to the point of ſight, till it meet the remoteſt line from the plan F. To find the reſt of the ſhadows; draw parallels to the line B C D, through the angles G H I; and inaſmuch as the ſun illuminates two ſides of the object, and makes the ſhadow broader, as is ſhewn in the figure, where G C and H I are the diagonal of the ſquare pieces; where theſe lines drawn through G C and H I cut the line A, a line muſt be drawn to the point of ſight E; and you will have the whole projection, or ſhadow of the object.

If it be a round object, as repreſented in the ſecond figure, a circle muſt be deſcribed, according to the rule given for arches in pages 62, 63, by erecting of perpendiculars, *&c.* And when the circle is formed, and its thickneſſes given, from the bottom of thoſe perpendiculars, parallels to the baſe muſt be drawn; as here K, L. Then taking L, which is the parallel of the middle of the circle, for the foot of the luminary, from the middle of the ſun M, draw a line paſſing over the circle N, and continue it till it cuts the parallel L in the point O; which will be the extremity of the ſhadow. The vacuity or aperture of the rotundo is found by drawing a parallel to N O from the point P, which is the top of the object oppoſite to the ſun, till it cut the line L O. The reſt of the rotundo will be found by drawing another little parallel to N O from the point R, which will give S. The reſt of the round object is found by drawing parallels to N O, through all the points of the circle of perpendiculars, which are to be continued till they cut the parallels to the baſe line; as is here done for that of the middle L O. I could eaſily mark them all with points, but I forbear it to avoid confuſion.


B
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S
L
K

Shadows *assume the Form of the Planes they are cast upon.*

HITHERTO I have considered shadows on the horizontal plane; being certain that a person who understands such, will find no difficulty in the practice of the rest which follow. For the rule is the same in all; and one single instruction will suffice to shew how shadows sink and rise according to the planes on which they are cast.

To shew that these shadows are formed by the same rule as those preceding, draw a line from the foot of the luminary A, through the plan of the door B; and another from the sun C, over the top of the same door at D; these lines will intersect each other, though without the limits of our page, and give the extremity of the shadow; as already is observed of the others on the horizontal plane. But the wall E preventing the line A B from being continued as it should be if the plane was horizontal, obliges it to rise, as we see in F G. For this reason the sun's rays, which should proceed to meet the line A B, cuts it on the wall in the point G, and there marks the form or shadow of the door; the top whereof is drawn to the point of sight H.

The shadow of the object K is cast in all its length K I, and passes over that other L. And it is to be observed, that the shadow still preserves its length, though it meets with a raised object in the way: and that the shadow which passes over any thing assumes the same figure, as here the shadow M and N takes the form of the object L, or rather is lost in the shadow of L.

Though I have made the sun to appear in all my figures, it must not be imagined that he is so near the objects. My intention was to shew that the rays proceed from him when at such a height, though far without the limits of the paper, as in this second figure, which yet has the line for the foot of the sun A B, and that of the rays of the sun C; by reason those are always required for finding the extremities of the shadow.

The shadow of the object O is found by continuing the line A B, and making it rise over the steps, and against the wall, till cut by the ray in the point S, by the rays passing over the corner of the object; and from S drawing a line to the point of sight T.

To find the shadow of the object P, it must be remembered (as already observed) that the foot of the light is always supposed on the plan where the object is placed. Accordingly the ray C cutting the little line A B, shews how far the shadow of the little object P must go, to be thence drawn to the point of sight T.

The object V casts it shadow the usual length, though in its way it descends into a pit and rises again.

The shadow of the wall R, is found by the same rule as the rest; as appears from the lines A B and the ray C.

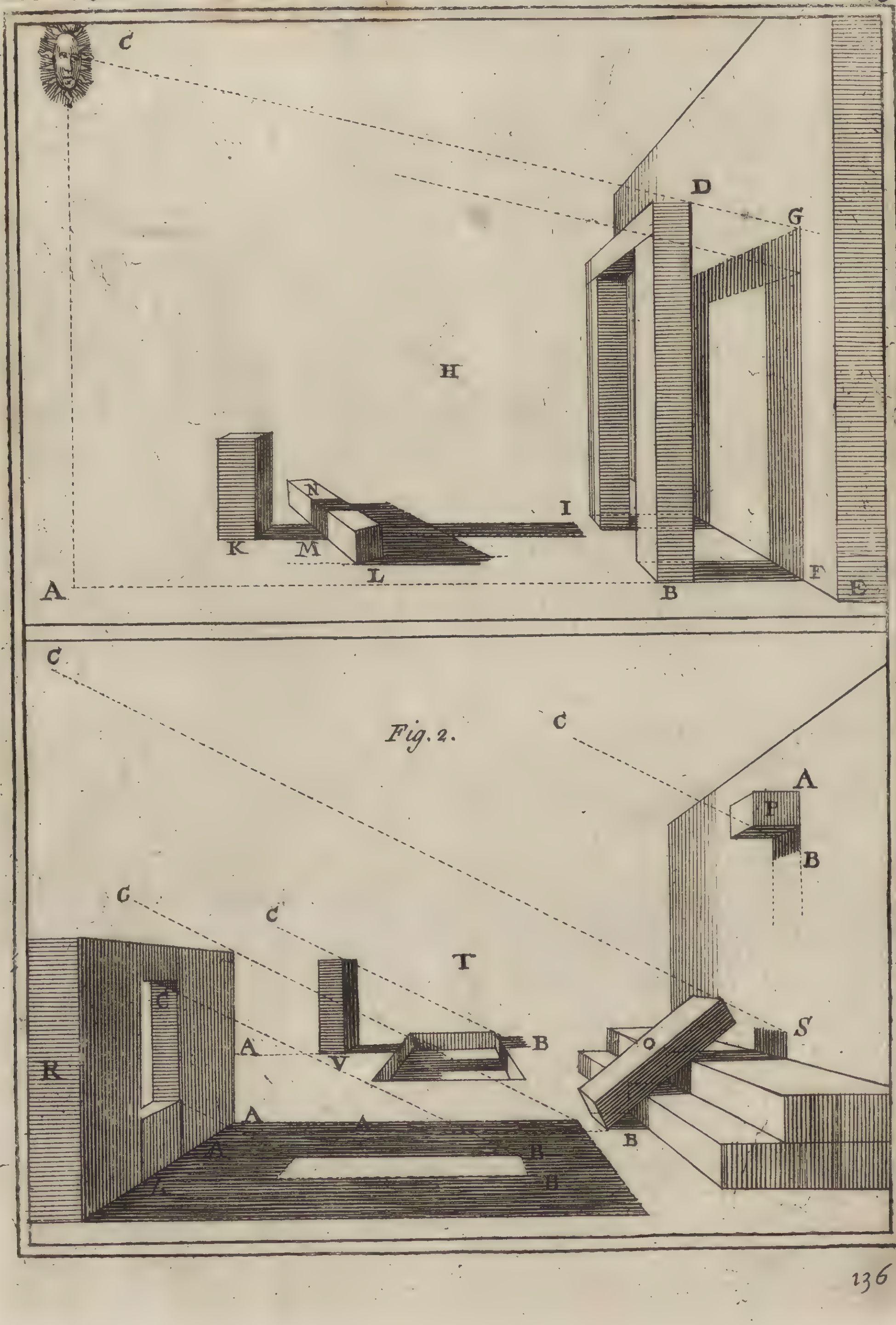
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Fig. 2.
C
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V
R
A
A
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B

To find the Shadows of Objects broader at Top than at Bottom.

WHEN the projection or ſhadow of a figure is required, whoſe top is broader or wider than the bottom, as in the two adjoining figures, the uſual method is, to make a plan, and draw perpendiculars, as B A, B A, from the ſame. The plan finiſhed, a line muſt be drawn underneath the ſun, as already mentioned, and parallels to this line be drawn from all the angles of the plan. Then a line is to be drawn from the ſun C, through one of the angles of the object, as D, till it cut the line of the plan of the ſame angle at F. Another line is to be drawn over the angle A, till it interſects the line B A in the point F. Then drawing lines from E and F to the point of ſight, you will have the ſhadow of the ſquare of the top of the object. Laſtly, drawing lines from the point of the figure H, to the points F and L, you will have the ſhadow of the whole figure, which is a pyramid inverted.

It is evident that the projection or ſhadow of the croſs underneath is performed after the ſame manner, which it is unneceſſary to repeat.

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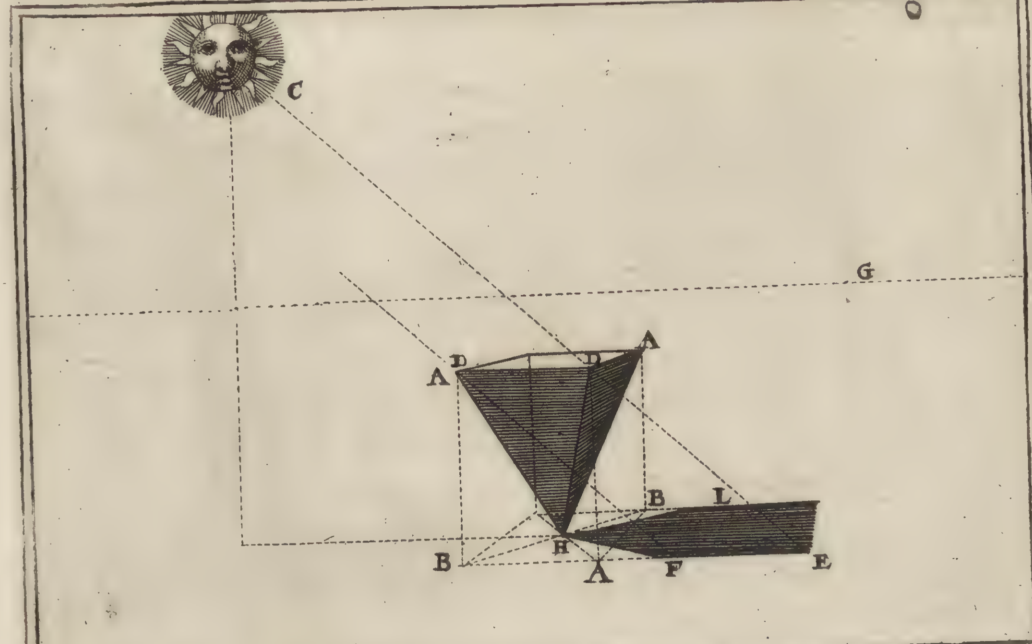

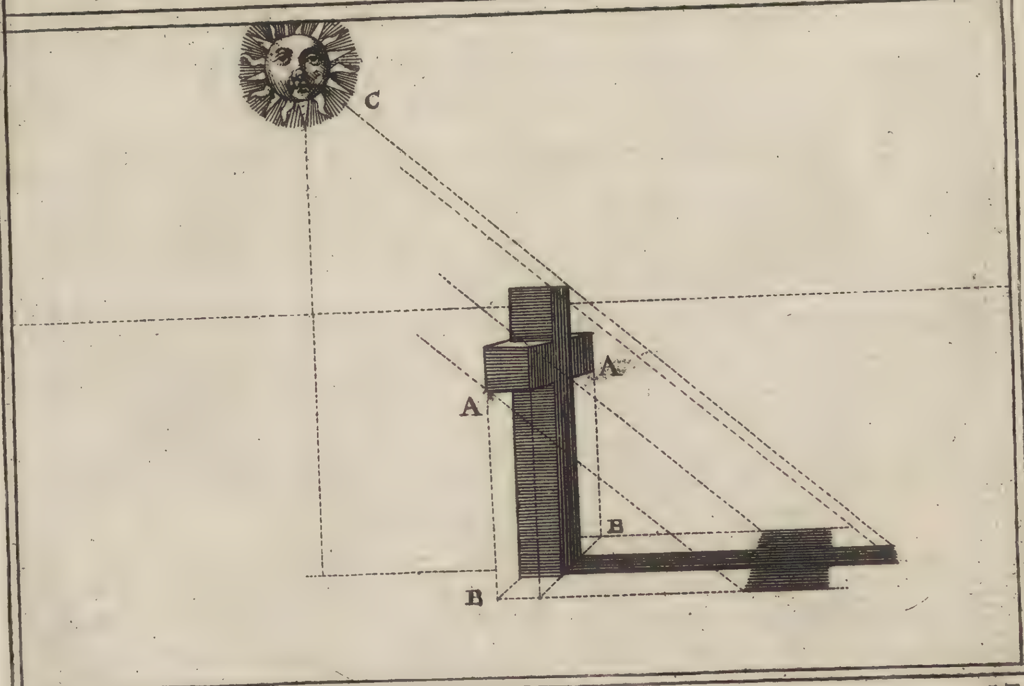

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To find the Shadows of Objects ſuſpended from the Ground.

THE method of finding the ſhadows of objects ſuſpended from the ground is rendered very eaſy by the preceding rule: all you have to do is to find the plan, and from the angles thereof to draw parallels to meet the perpendicular line under the ſun, and then, from the ſame angles of the objects ſuſpended in the air, to draw other lines, cutting thoſe drawn from the plan; by which means you will find the extremes of the ſhadows, as already mentioned under the preceding figures.

I am clearly perſuaded, that my reader would eaſily conceive the method of theſe, or any ſhadows made by the ſun, without farther explanation of the figures here annexed, they being all intelligible, and performed by the rules already taught.

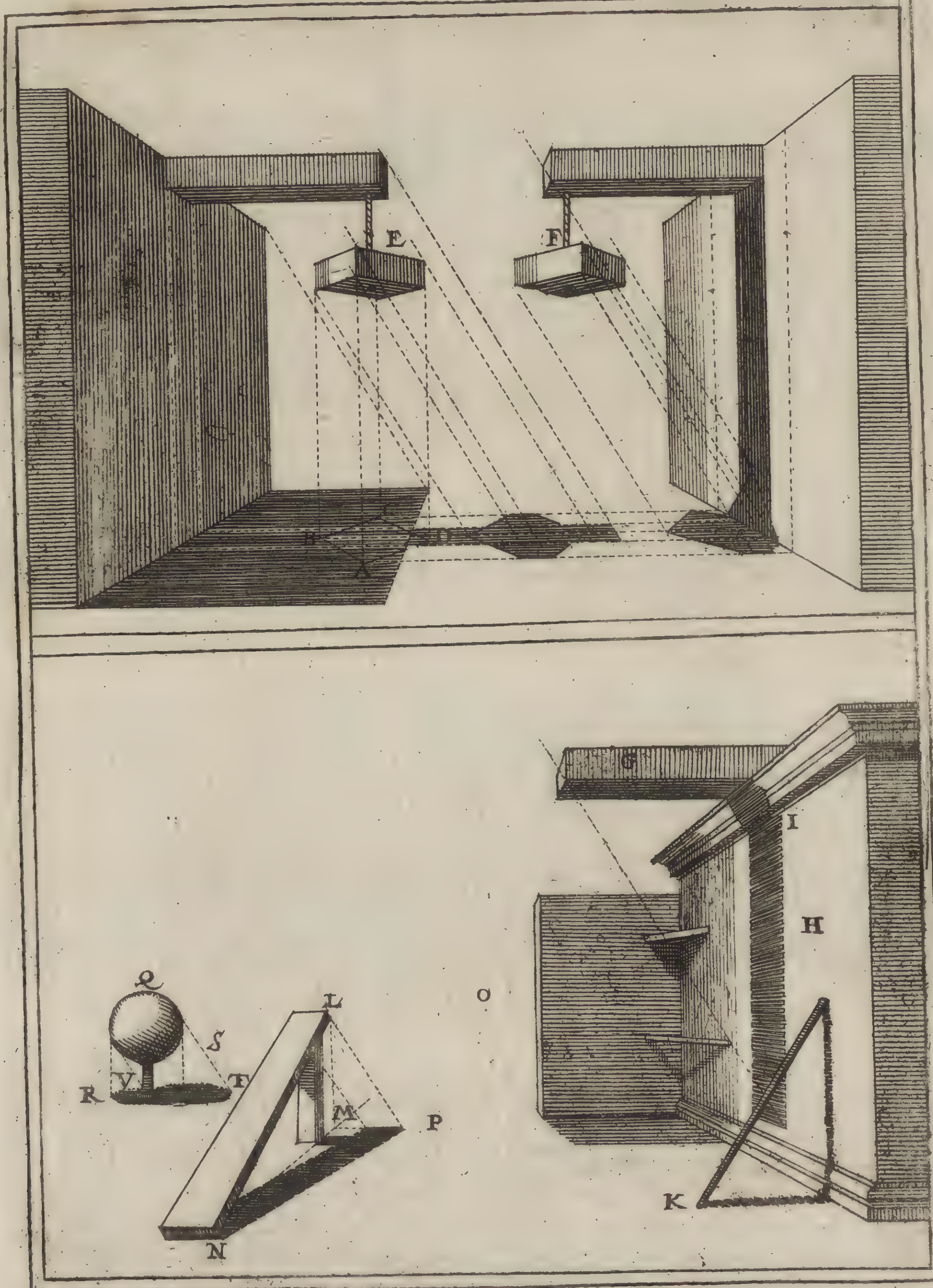
However, as every inſtance has ſomething particular therein, it may not be improper to take notice thereof, that there may be nothing but what is eaſily underſtood.

I obſerve then, that in the firſt figure the plan A B C D is alone made uſe of, to find the ſhadows of the objects E F, by reaſon they are both on the ſame line, and of the ſame height.

In the ſecond, it muſt be obſerved, that the piece of wood G caſting its ſhadow on the wall H, the ſhadow makes that ſame figure at the cornice I underneath. And the ſame is obſervable of the ſtick K, raiſed againſt the wall H.

To find the ſhadow of the board L, the rule already delivered for objects broader at top than at bottom, muſt be remembered; for having drawn the perpendicular M, where it cuts the ray N O, you muſt draw the line from underneath the ſun M P. Then from the board L, drawing a line to cut the line M P, the point of interſection will be the extremity of the ſhadow.

The ſhadow of the globe or ball Q is likewiſe found by letting fall two perpendiculars, of which the plan is to be formed, then through the center of this plan drawing a line from beneath the ſun R, and a tangent from the ſun, as Q S, till it cut the line R in the point T, and laſtly another, as V, cutting the ſame line R: this interval T V will give the extent of the ſhadow of the ball.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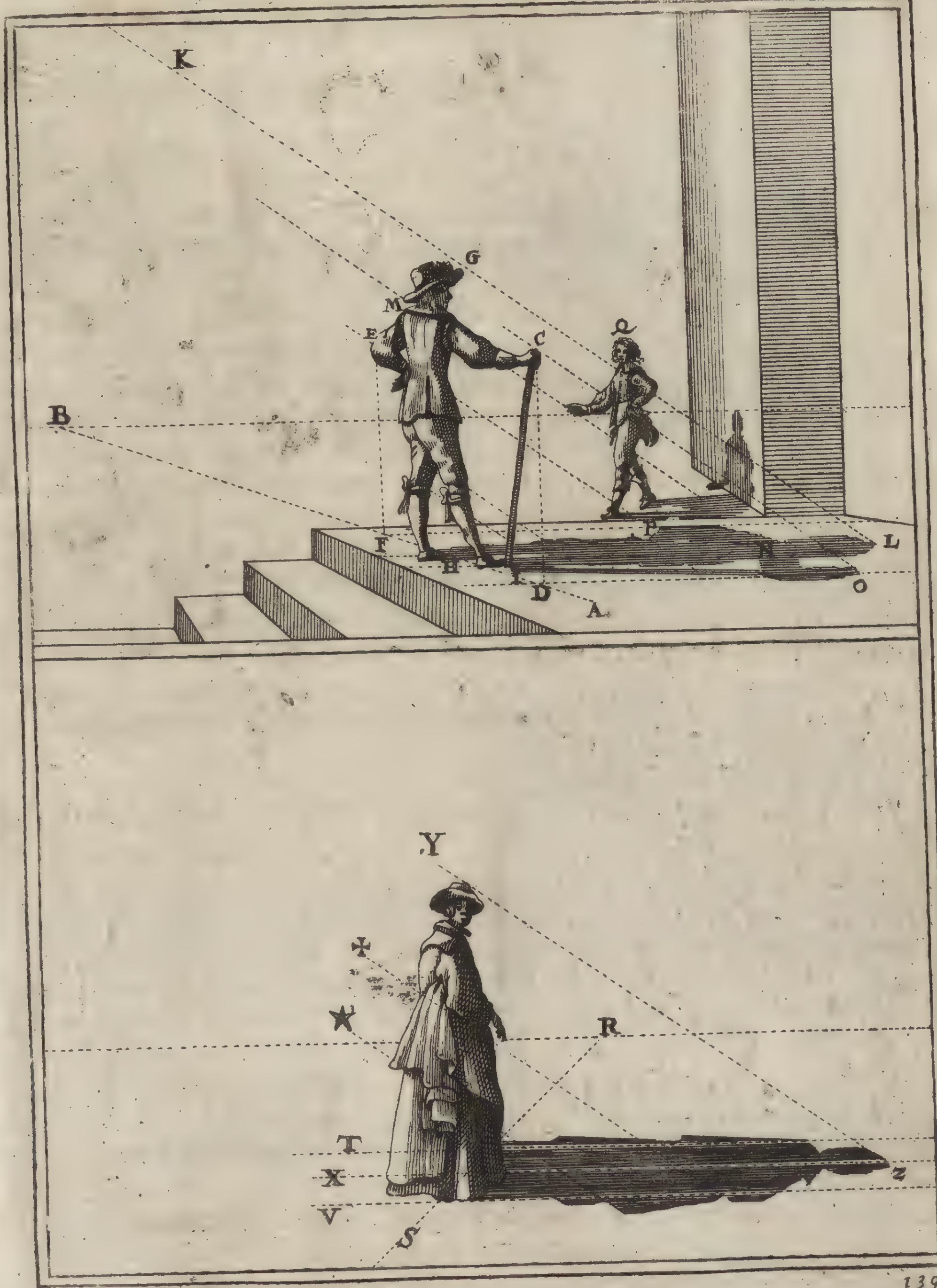
To find the Shadows *of human Figures, caused by the Light of the Sun.*

THE ſhadow of figures is found by the ſame methods as thoſe of other bodies, that is, by parallels both from underneath the figure, and from the ſun; with this difference only, that the ſhadow of other bodies or objects is found by means of their plan, whereas figures have none. But in lieu of ſuch plans, a line muſt be drawn underneath the figure, and on this line, the ſeveral remarkable points of the figure to be let fall perpendicularly, which line is to ſerve as a plan.

For example, *In a figure naked, or undreſſed without a cloak or gown*, as the firſt figure hereto adjoining, with its back towards us; from under its feet, as A, draw a line to the point of ſight B, and to this line A B draw occult lines from all the points that may contribute to the true ſhadow; thus from the hand C, let fall a perpendicular, cutting the line A B in the point D, and from the elbow E let fall another to the point F, and a third from the head G to the point H, and from all theſe points D F H, as alſo from the end of the ſtaff I, draw parallels to the baſe line.

Then having determined the height of the ſun, a line muſt be drawn from the ſame, as K, paſſing over the edge of the hat G, and continued till it cut the line H in the point L, which will be the extreme of the ſhadow. And again, from the hind edge of the hat M, draw a parallel to K G L, till it likewiſe cut the line H in the point N, theſe two points N and L will be the ſhadow of the hat. A third parallel muſt be drawn through the point C, till it cut the line D in the point O, this point O will be the ſhadow of the hand that holds the ſtaff; drawing therefore a line from the point O, to the point I, the line O I will be the ſhadow of the ſtaff. A fourth parallel is to be drawn through the point E, which cutting F in P, will be the ſhadow of the elbow. The ſame do from all the other parts, as the knees, the feet, *&c.* Theſe ſeveral points connected together, give the ſhadow of the whole figure. The ſhadow of the little figure Q is done by the ſame method. I have not expreſſed all the points and parallels therein, in order to avoid confuſion.

To find the *ſhadows of figures cloathed in long garments*; draw a line from under their feet to the point of ſight, as here the line S R, and through the bottom of the robe draw two parallels to the baſe line, each way, as the lines T and V, and between the two another line X for the middle of the figure. Then from the top of the head draw a line Y, for the ray of the ſun, to be continued till it cut the line X in the point Z; which point Z will be the extreme where the ſhadow is to terminate. The reſt of the ſhadow will be drawn between the two parallels T and V. If any thing comes over them, as the two plaits or folds † and *, they muſt be drawn by parallels to Y Z, till they cut the line V. And thus † gives the ſhadow of the elbow, and * that of the folds of the gown.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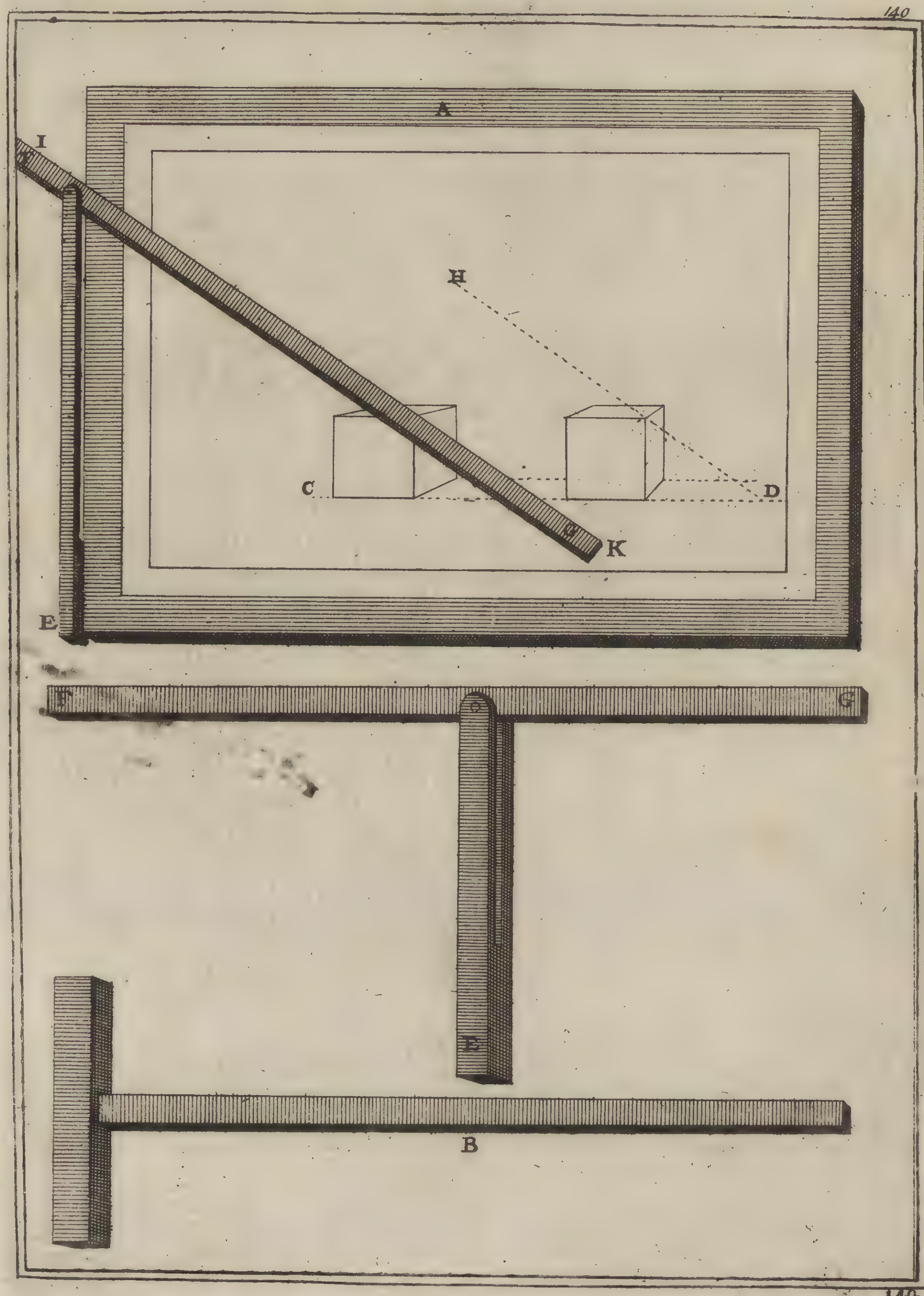
An easy Method of finding the Shadow *of a Body from the Sun.*

WERE I here to add the ſhadows of all the objects that might be given, it would be a work without end, objects being multipliable to infinity; in effect, beſides the greatneſs of their number, each particular one might furniſh out a whole book, as being capable to be turned, inclined, and diſpoſed in many and various manners, each of which has its ſeveral ſhadows. But the labour would be uſeleſs, inaſmuch as every body will be prepared to make any at pleaſure, provided he be maſter of two or three rules already laid down for the ſhadows of objects taken from the ſun, two kinds of lines have been ſhewn to contain the means for finding all ſhadows imaginable; one of the lines coming from under the ſun, and paſſing over the plan, and the other proceeding from the ſun itſelf, and paſſing over the object, and cutting the former line in the place where the ſhadow is to terminate. But as theſe lines are to be all parallel, that is, thoſe from under the ſun parallel to each other, and thoſe from the ſun likewiſe parallels among themſelves, it may be neceſſary to give a method of drawing them with expedition and advantage.

I have already ſhewn how to draw parallels to the baſe by means of a ſquare board, as A, and a ruler B, which ſame may ſerve to draw the lines from under the ſun, when found directly over the face of the object, as the line C D. But where he illuminates the object from an angle, another inſtrument muſt be uſed, as that here repreſented E, which is a rule faſtened to the end of another piece of wood, well ſquared, and grooved quite through, ſo as the rule F G may be moveable therein with ſome force, and that having taken an inclined line, as H D, another parallel thereto I K may be taken by means of this bevel, which is the name the workmen give this moveable ſquare E F G. This inſtrument ſhortens the work exceedingly, when ſhadows are to be made by the ſun, on which occaſion there is no line of any inclination whatever, but parallels will be required thereto. The application will evince its uſefulneſs. For ſhadows by the candle or torch, it is of no importance, by reaſon all the lines are there drawn from a center.


140
A
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140

Shadows from a Torch, Flambeau, Candle, *and* Lamp.

IT has been already obferved, that there are two points required for the finding of fhadows; the one the foot of the flambeau, candle, lamp, *&c.* which is always found on the plane where the object is placed, the other in the fire, or flame of thofe luminaries.

From the firft point, which is the foot of the flambeau, or beneath the lamp, *&c.* lines muft be drawn through all the angles of the plan of the object, whofe fhadow is required; and the fecond point gives other rays, which paffing through the angles of thofe objects, interfect the former lines, and fhew where the fhadow is to terminate. I fhall illuftrate this by an example, wherein the fame letters fhall be ufed for all the three luminaries, from which it will readily appear, that the practice is the fame in all. With this only difference, that the foot of the flambeau or torch actually ftands on the plane, and that the others are only conceived to do fo.

I add then, that if the fhadows B of the cubes A be required, lines muft be drawn from the point O, which is the foot of the luminary, through all the angles of the plans of thofe cubes, as O D, O E, O F, O G, and then from the point C, which is the light or fire of the luminaries, other lines muft be drawn through the angles of the objects, and continued till they interfect the former lines from O.

Thus having drawn a line from the point O through the angle of the plan D, drawing another line from C, through the correfpondent angle of the object P, this latter line being continued, will cut the firft from the angle D in the point H, which point will be the fhadow of that angle D P. From the fame point C, do the fame for all the other angles of the plan in the points HIKL, which points being connected by right lines, give the fhadow of the cubes, as in the three figures. From this inftance it readily appears, that the method is the fame in one as another.

In the following page we fhall fhew how to find the bottoms or feet of candles and lamps.

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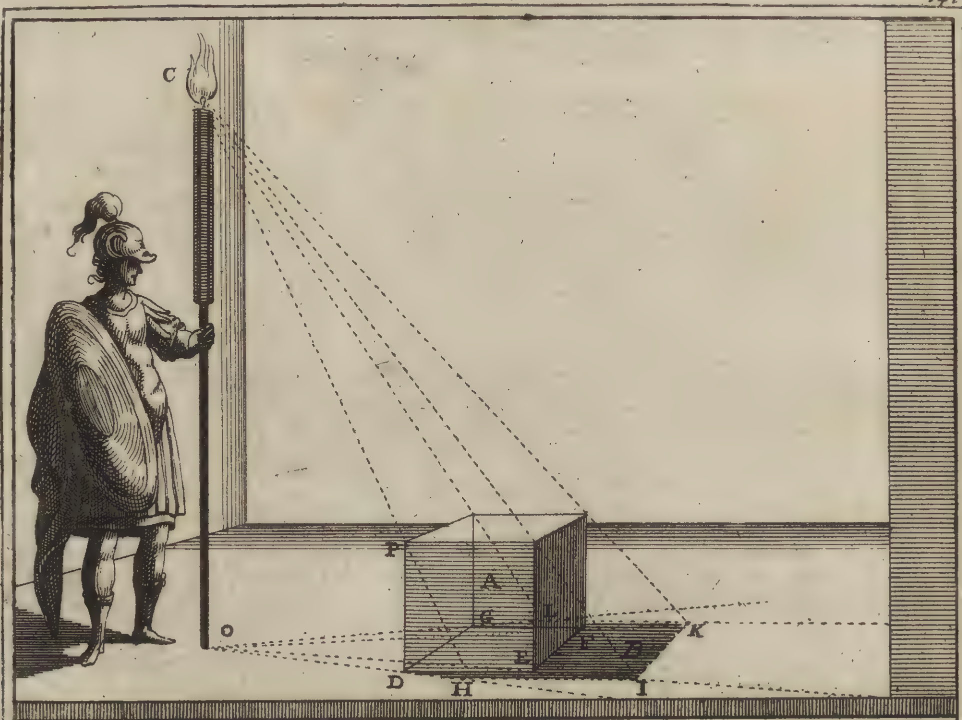

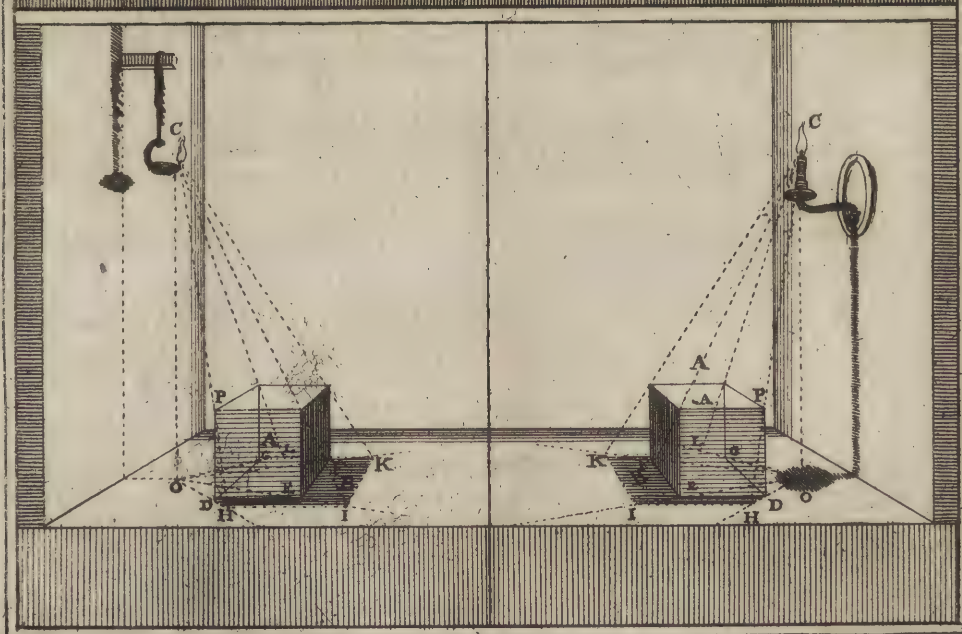

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Of the foot of the Luminary.

SINCE the method of finding ſhadows by the torch, candle and lamp is the ſame in all, as already obſerved, there is no occaſion for diſtinguiſhing between them in any of the following rules. For when I put a candle, a torch or a lamp might as well be put in its place, the light of one having the ſame effect as that of any of the reſt. So that for the future, we ſhall uſe the word light indifferently for all three.

As to the foot of theſe luminaries, which muſt ſtand on the plans where the objects are placed, it is found after the following method.

A lighted torch being in a chamber, whether in a corner, at a ſide, or in the middle thereof (inſtances of each hereof we have in the erected figure) we muſt conſider all the parts of the room, namely, the cieling, floor, ſides, *&c.* as having points wherein the foot of the luminary may be placed, and that from theſe points lines may be drawn through all the angles of the plan of the object whoſe ſhadow is required, as ſhall be expreſſed more at large in the following page, my chief deſign in this being to ſhew how that point is to be found. The torch then being placed in A, this point A is the foot of the light, and B the light or fire of the torch, which fire is there ſuppoſed immoveable, though the foot may be found on all ſides.

To find the foot of the luminary on the ſide of the wall C, draw a parallel to the baſe line from the point A, till it cut the ray D E in the point F, from which point erect a perpendicular F G. Then from the point B, which is the fire, draw another parallel to the baſe line till it cut F G in the point H, which H will be the foot of the luminary; as if the torch were laid all along, its fire ſtill remaining in the point B.

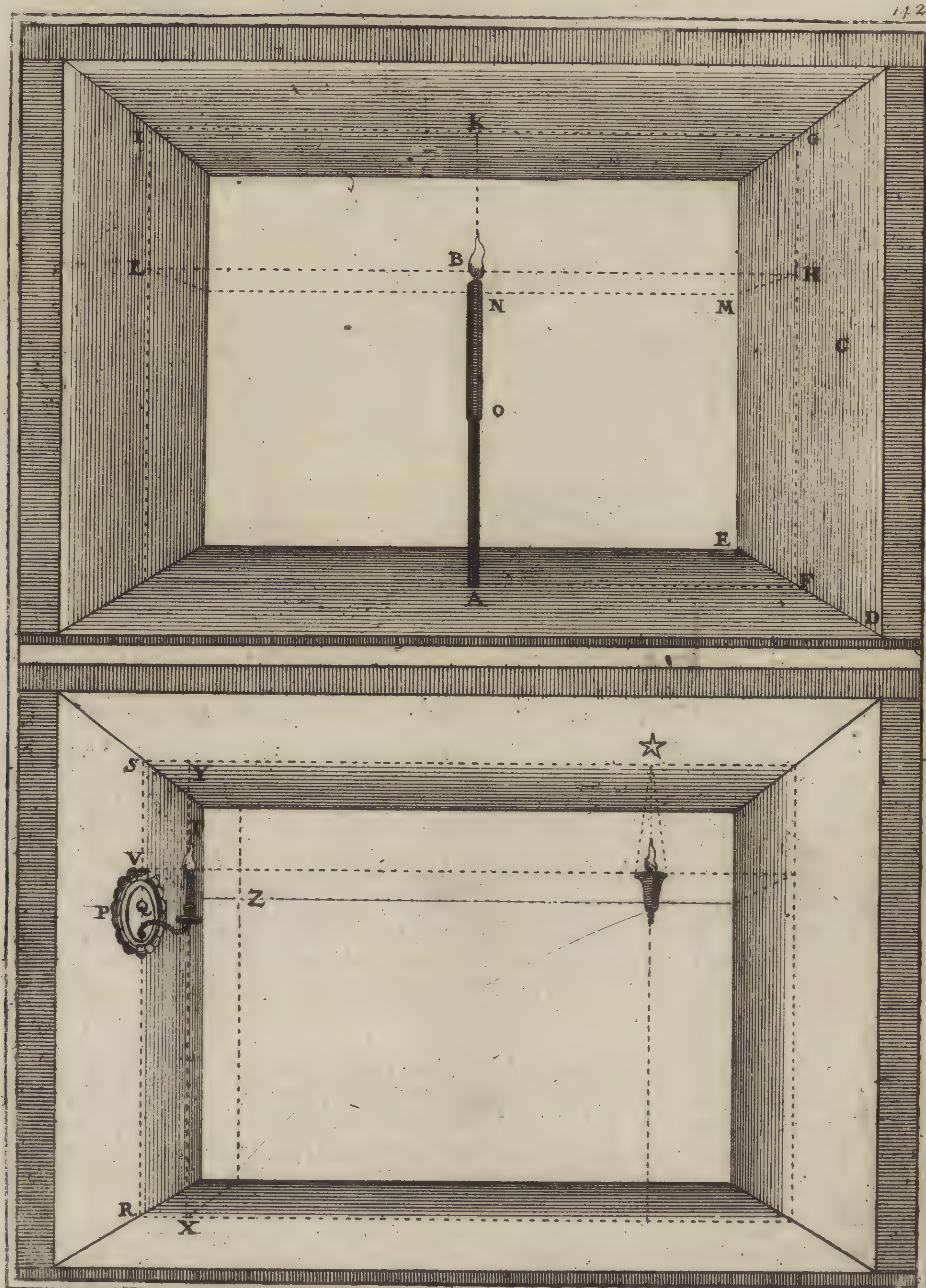
To find the foot of the ſame luminary on the cieling, from the point G draw a parallel to the baſe line, as G I, and from the point B erect a perpendicular to the ſame G I; this gives the point K for the foot of the luminary, as if the torch were turned upſide down.

To find it on the other ſide of the room, the ſame method muſt be obſerved as for the ſide C, and you will have the point L.

To find the foot of the luminary in the middle of the room, draw a line from the point H to the point of ſight, till it cut the perpendicular E in the point M. Then from M draw a parallel to the baſe line, interſecting the torch in the point N; this point will be the foot of the luminary for the middle of the room.

The foot of a candle is found after the ſame manner as that of a torch, taking the middle of the foot of the candleſtick for the foot of the luminary; but when it is a plate, or an arm fixed in the wall, it is this arm or branch, that determines the line where the foot of the luminary ſhall be. For inſtance, in the plate P, through the arm Q draw a perpendicular to the baſe line, as R S. Then from the fire T, draw a little parallel to the baſe line, which cutting R S in the point V, gives the foot of the luminary for that ſide. The point X will be the foot for the floor, the point Y for the cieling, and Z for the front wall of the room.

As to lamps, it is the place they are hung in that determines the foot, as here the character *; from which place a parallel to the baſe line is drawn as far as the firſt ray, *&c.* The reſt the ſame as in the torch or candle.


142
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To find the Shadows of a Torch *on all the Sides of a Room.*

THE ſhadows taken from the ſun always tend towards the earth, by reaſon that ſtar never gives us any of its light, but when above our horizon, and of conſequence raiſed above our ordinary objects, and ſo occaſioning their ſhadows to deſcend. But the caſe is different in torches, candles, and lamps, which may be placed either above, below, or on the ſides of objects, and therefore may yield ſhadows on all ſides, as we are now to ſhew.

The preceding figure will help to find the ſhadows of objects diſpoſed on all ſides of the room, for having found the foot of the luminary as already directed, there is nothing difficult behind, the method throughout being the ſame with that for the cube in page 141. to which recourſe may be had. However, to ſave you the trouble of going ſo far back, I ſhall here obſerve, that to find the ſhadow of the table the torch is placed in, you muſt draw lines from the foot of the torch A, through all the feet of the table C. Then from the point of light B, draw lines over all the points of the table I I I, *&c.* till they interſect the rays C C, *&c.* in the point O O, *&c.* which will give the bounds of the ſhadow of the table.

The ſhadow of the object D is found by drawing lines from the point A, through all the angles of the plan, as far as the angle of the wall D, and from that angle raiſing them perpendicularly. Then from the point of the light B, drawing lines over the object D, and obſerving the angles correſponding to the lines of the plan, you will have the ſhadow F of the object D.

The ſhadows of all the other pieces are found after the ſame manner: ſo that all we ſhall here note, is the foot of the luminary, the fire itſelf being ſuppoſed to be fixed in the point B.

For finding the ſhadow of figure G, the point L is the foot of the luminary.

To find the ſhadow of figure N, the point H is the foot of the luminary.

To find the ſhadows of the figures I and M, the point K is the foot of the luminary.

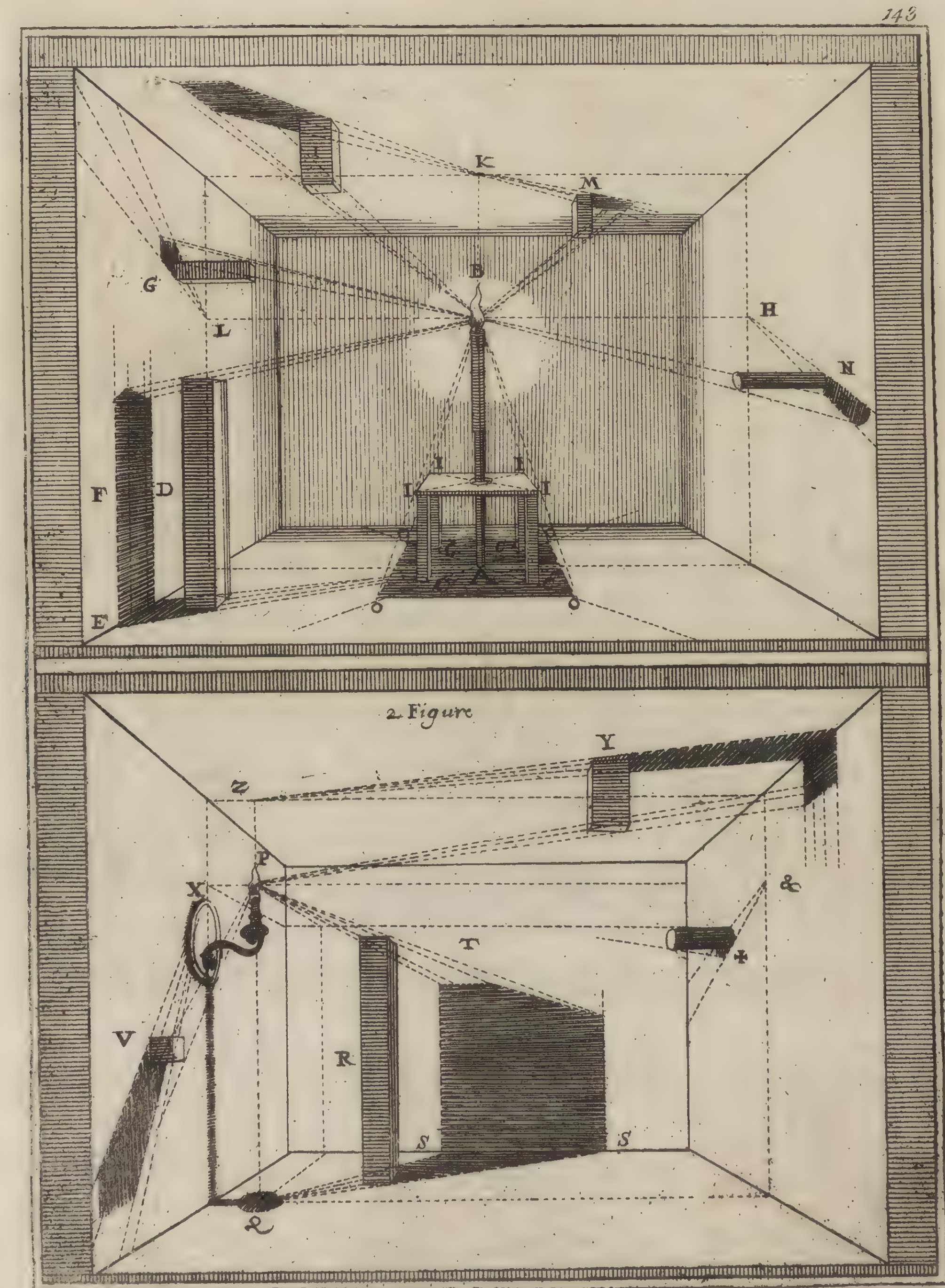
For the ſecond figure; having found the foot of the luminary on all the ſides of a room, as directed in the preceding page, the ſhadows of objects are found in any place at pleaſure by the rule now delivered. For example, having found the foot of the luminary Q and its fire P, if you would have the ſhadow of the object R, draw rays from the point Q over the plan of the object, continuing them indefinitely. But inaſmuch as they meet with the wall, or ſide of the room T, in the places S and S, where they meet the ſame, they muſt all be raiſed; then drawing other lines from P over the ſame object R, they will cut thoſe of the plan, and mark the place of the ſhadow upon each, obſerving that the angles refer to the lines drawn from the plan.

This method is ſo univerſal, that a man who only knows how to take the ſhadow of a cube, will make no difficulty of finding the ſhadow of any other object whatever. For this reaſon, having deſcribed that method for the cube in page 141. and added this above, which in effect is the ſame; I imagine I have given abundant inſtruction for the managing of all ſhadows, and may be excuſed from repeating the ſame in the ſeveral figures following. Wherein all I ſhall note, is the point for the foot of the luminary.

To find the ſhadow of the figure V, the point X is the foot of the luminary.

To find the ſhadow of figure Y, the point Z is the foot of the luminary.

To find the ſhadow of the figure +, the point & is the foot of the luminary. P is the fire, or light itſelf, for all the objects in the ſecond figure.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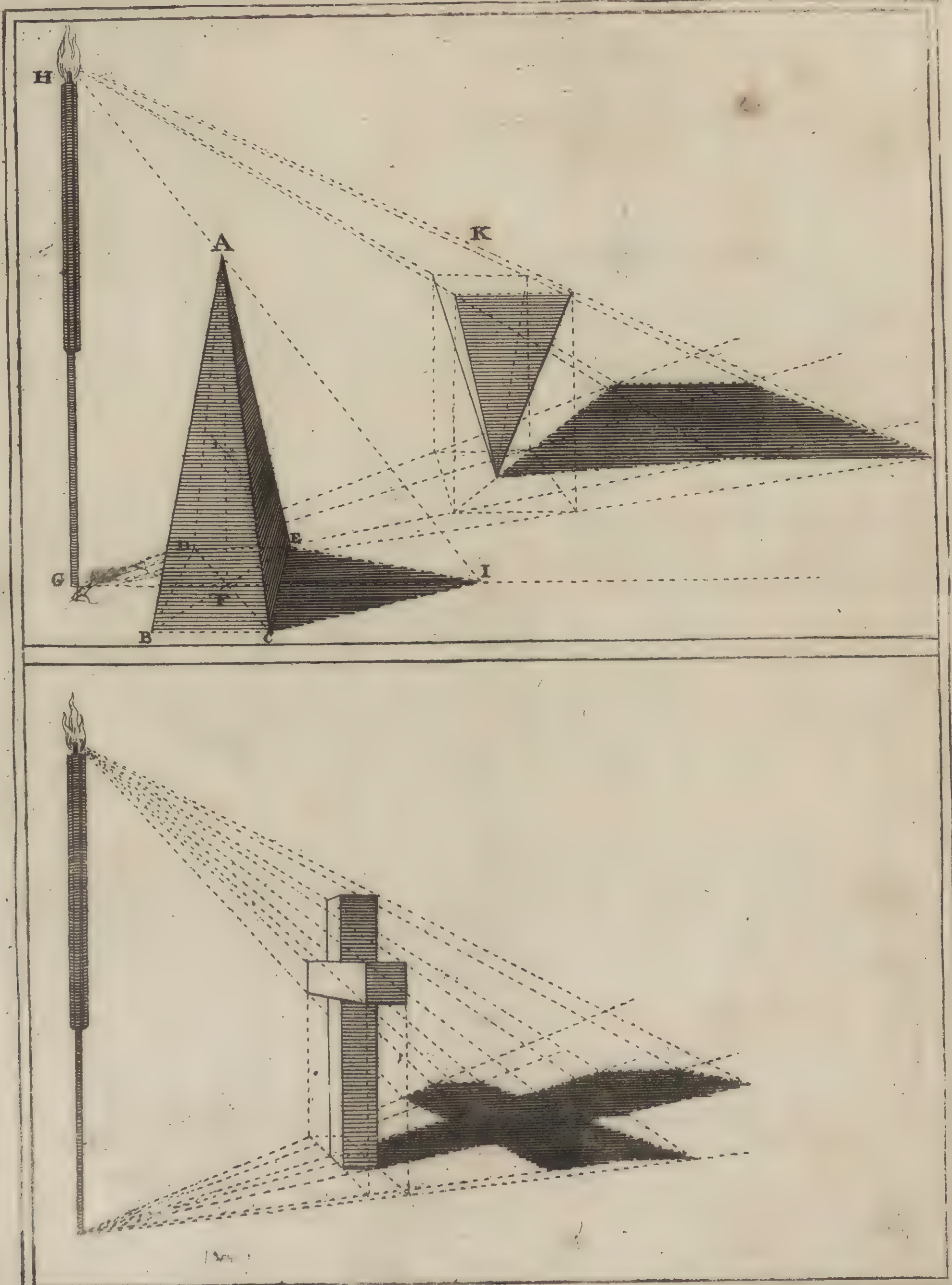
The Shadow of an erect and inverted Pyramid by Torch-light.

THE ſhadow of an erect pyramid by torch-light, falls as it would by the light of the ſun, and in both caſes there is but one line wherein the vertical point of the pyramid will be found. Upon the plane B C D E draw the diagonals E B and D C, through the central point F raiſe the perpendicular F A, and from the four points B C D E draw lines to the point A, and the pyramid will be erected. Then to find its ſhadow, draw an indefinite line from the baſis G of the illuminating body, paſſing through F, and from the central flame of the torch H draw another line over the vertex of the pyramid in the line G F, till it cut the point I, which point will limit the ſhadow of the pyramid. Laſtly, draw a line from C to I, and another from E to I, and the triangle C I E will be the ſhadow of the pyramid.

To gain the ſhadow of an inverted pyramid, draw perpendicular lines from the angular points of its baſe, and form the ſubjacent plane by means thereof, after the manner directed for the ſun, page 138. And from all the angles of this plane, draw lines to the baſe of the torch G, then from H, the central point of the flame draw other lines, touching all the angles of the baſe of the inverted pyramid, and dividing thoſe of the plane, whereby the ſhadow will be defined; as we before obſerved, in other inſtructions relating to the torch.

The Shadow of a Croſs.

WE before conſidered the ſhadow of a croſs by the ſun, let us now ſuppoſe the ſame object placed in the light of a torch, that we may find the difference between the two caſes. The conſtruction of the latter is obvious enough, particularly if compared with the method of finding the plane, delivered in page 137, and the other directions laid down for ſhadows by torch-light.



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To find the Shadows *of round Objects by Torch-light.*

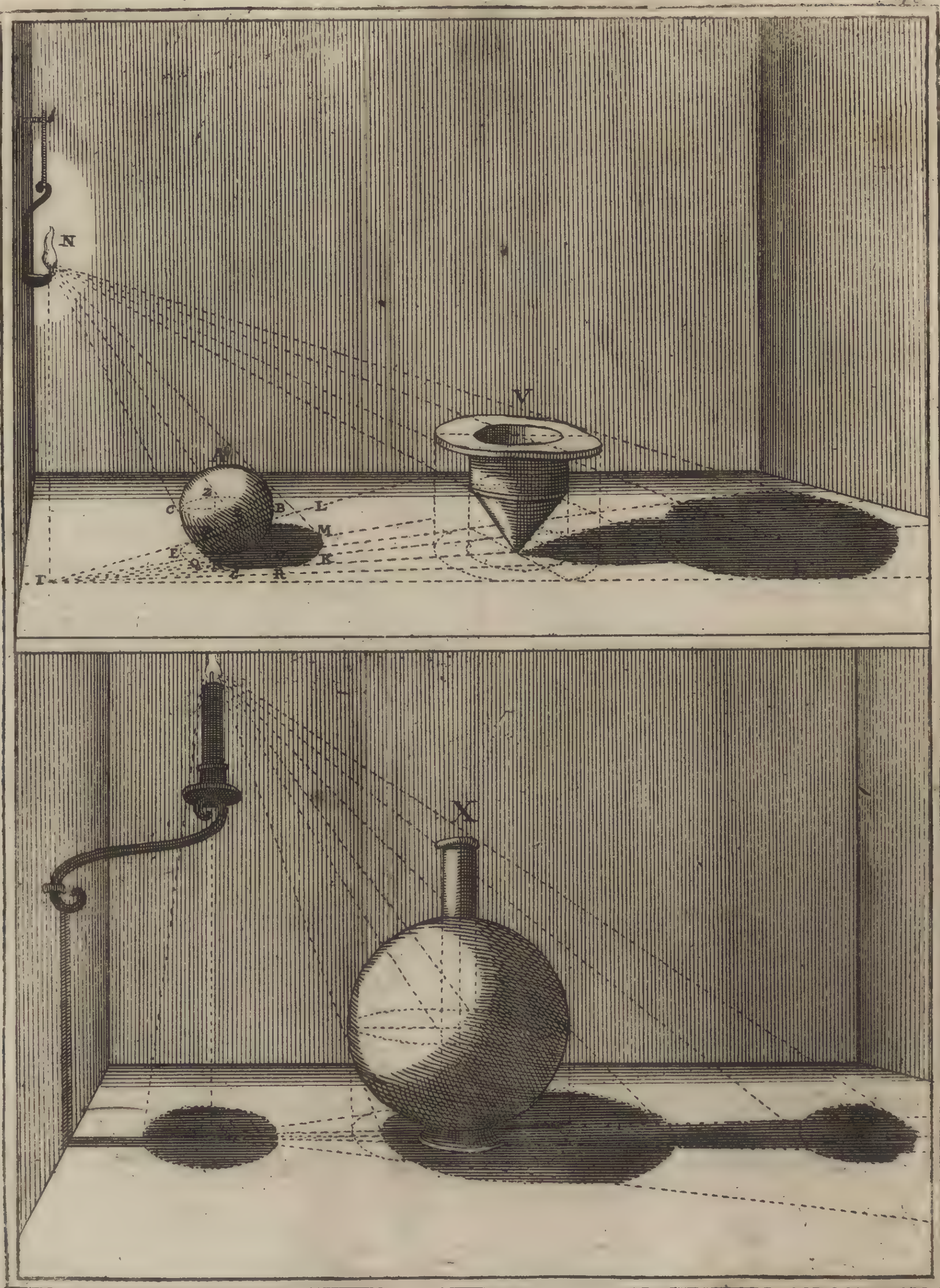
THERE may ſeem to be more difficulty in repreſenting the ſhadows of globes, bottles, drinking-veſſels, and other bellied objects, by torch-light, than in thoſe of ſquare ones, but the directions already given will ſerve for theſe alſo; for there is nothing more required here, but to reduce ſquares to rounds, as we taught in pages 19, 20, 28, 29, and 86; which contain all the neceſſary inſtructions for giving the plans of round objects in perſpective, whence all other caſes of that kind may be eaſily underſtood.

We gave in page 138, the method for finding the plan of a ball, and by means of that plan, the preciſe magnitude of the ſhadow by the ſun. But as the caſe of the torch differs from that, we ſhall be a little more particular upon the ball, becauſe it will facilitate all the other directions relating to rounds.

Having by means of a pair of compaſſes marked out the great circle of the ball A, draw its diameter B C, and below this circle draw a line parallel to B C touching the circle in the point H. Then from the extremes of the diameter B C let fall perpendiculars upon the line below, as B D and C E, and with theſe points D and E make a plan D E F G in the uſual manner, the diameter whereof F G, will divide D E at the point H. And this plan will ſerve to find the ſhadow of the ball A. Now, having drawn from the baſis of the illuminating body I, lines touching this plane on both ſides, as I K and I L, and another I H M, through the center of the plane H, as alſo lines from the center of the flame N, which touching the ball between A and B, ſhall divide the line I H at the point M: this point muſt terminate the ſhadow. To gain the firſt part of this ſhadow, draw from the ſame point N another line, touching the fore-part of the ball, and dividing alſo the line I H at the point Q, then the diſtances between Q and M will be the length of the ſhadow. And for its breadth, draw from the ſame point N two lines touching the extremes of the diameter of the ball Z Z, and dividing the lines I K at the point R, and I L at the point S. Now then, as R S is the breadth of the ſhadow, and Q M the length of it, if the four points R S Q M be joined with curve lines, there will be an oval formed for the ſhadow of the ball A.

I have been the larger upon this ſhadow, becauſe I judge the direction given about it alone ſufficient for finding the other ſhadows of rounds, as of the object V, for example, which having two unequal breadths, ought to have a plan of two circles. And the figure X having three, ſhould have its plans correſponding thereto, one for the neck of the bottle, another for its belly, and a third for its foot; all which are to be made as thoſe for the ball.

An inſpection of the figures will render any farther explanation of them unneceſſary.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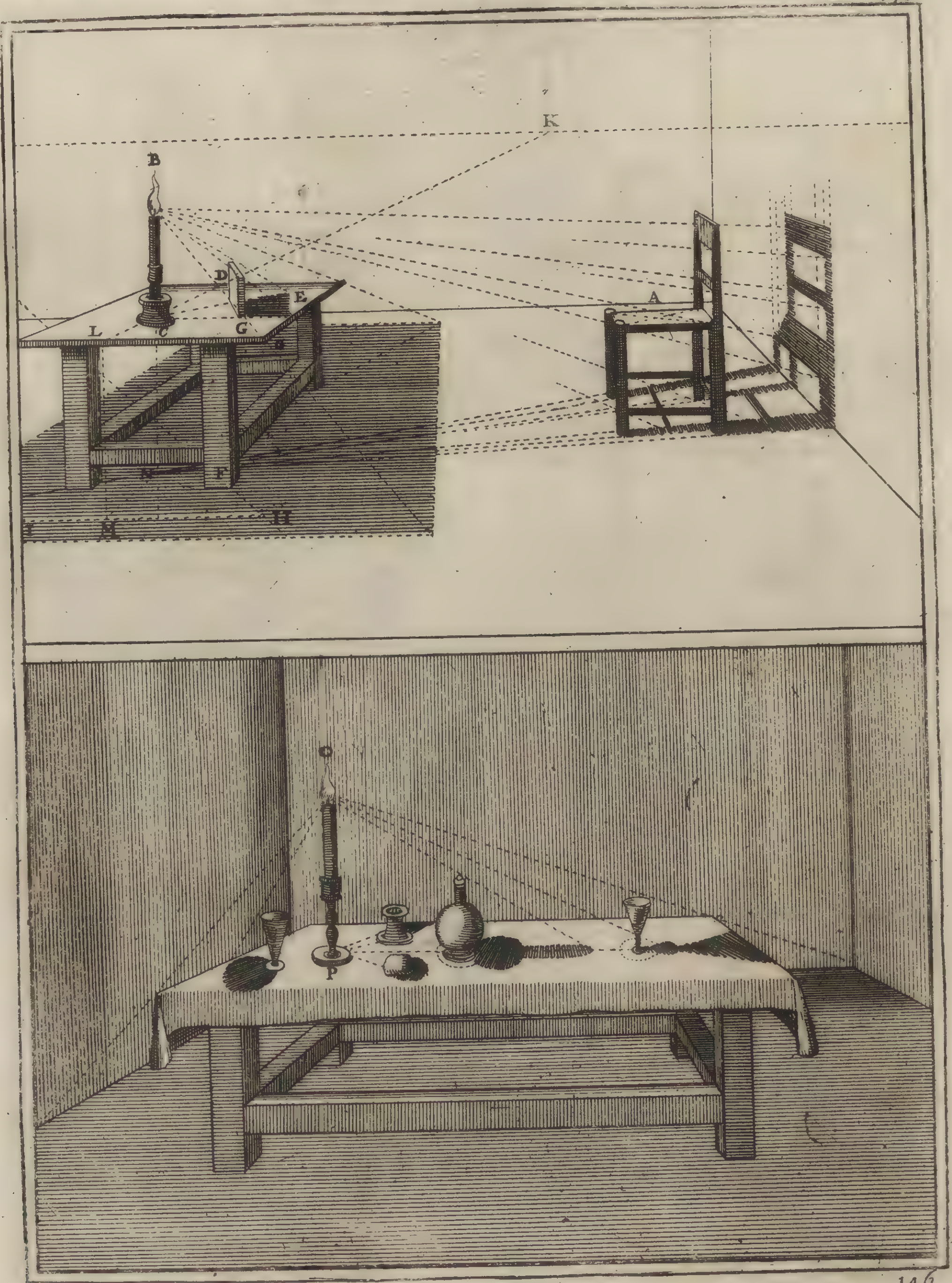
Shadows *on several parallel Planes.*

THE firſt plane here is the floor whereon the chair A ſtands; the ſecond plane is the upper part of the table, parallel to the firſt, and may be either above or below it. There might alſo be more of theſe planes wherein to find the foot of the illuminating body, in order to come at the ſhadow of the object. Suppoſe the foot of the illuminating body to be C, and the flame B; from theſe points C and B draw lines through the upper and under part of the object D; which will give the ſhadow E upon the table.

To find the ſhadow of the chair A, which is placed on the ground; determine the foot of the luminary on the table in C, on the ground: this is cleared by the inſtructions following.

From the point of diſtance, which is here ſuppoſed without the limits of the paper, draw a line through the foot of the table F; then from the angle G upon the table, let fall a perpendicular cutting the line F in the point H; and from H draw a parallel to the baſe H I, which is equal to the upper part of the table, and will direct us to the thing required. For, drawing a line from the point of ſight K through the foot of the luminary C, to the extremity of the table L; from the ſame point L, let fall a perpendicular to H I, which will give the point M. Then from M draw a line to the point of ſight K; in which line M K will the foot of the luminary be found. To determine the preciſe point let fall a perpendicular from the point C, which, cutting the line M K will give the point N for the foot of the luminary. This point N thus found, there will be no difficulty in finding the ſhadow of the chair A, the method being the ſame as for the other objects taught in the preceding pages: that is, from the foot of the luminary N draw lines through all the angles of the plan of the chair, and other lines through the upper part of the chair, from the luminary B; theſe latter by interſecting the former expreſs the bounds of the ſhadow. For the reſt the figure gives ſufficient directions.

The ſecond figure is not here added as if there were any particular circumſtances different from thoſe of the figure above, but only to put you upon recollecting what has been already taught; namely, that objects caſt their ſhadows differently, according to their different diſpoſitions about the luminary. Thus the little objects on the table project their ſhadows this or that way as the luminary is on this or that ſide, as is found from the common rules relating to the foot of the luminary, and the light itſelf. Moſt of the objects here repreſented are broader at the tops than bottom; ſo that it will be neceſſary to make plans thereof, after the manner already ſhewn.



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Shadows *of* Cielings *by Torch-light.*

THESE figures are not placed in the ſun's light, becauſe that luminary is high above all the objects of the earth, and conſequently can give no ſhadow where the illuminating body is ſuppoſed to be under the object. If it be ſaid, though the ſun's rays enter a room, yet the ſhadows of bodies continue to appear; I anſwer, that ſuch ſhadows are not immediately cauſed by the ſun, but by the light reflected into the room from other objects; and that they cannot be repreſented by parallel lines, as thoſe of the ſun, but by rays iſſuing from the ſame center, as thoſe of a torch, taking the reflecting body for the illuminating point, and proceeding in drawing ſuch a ſhadow as in the caſe of a torch.

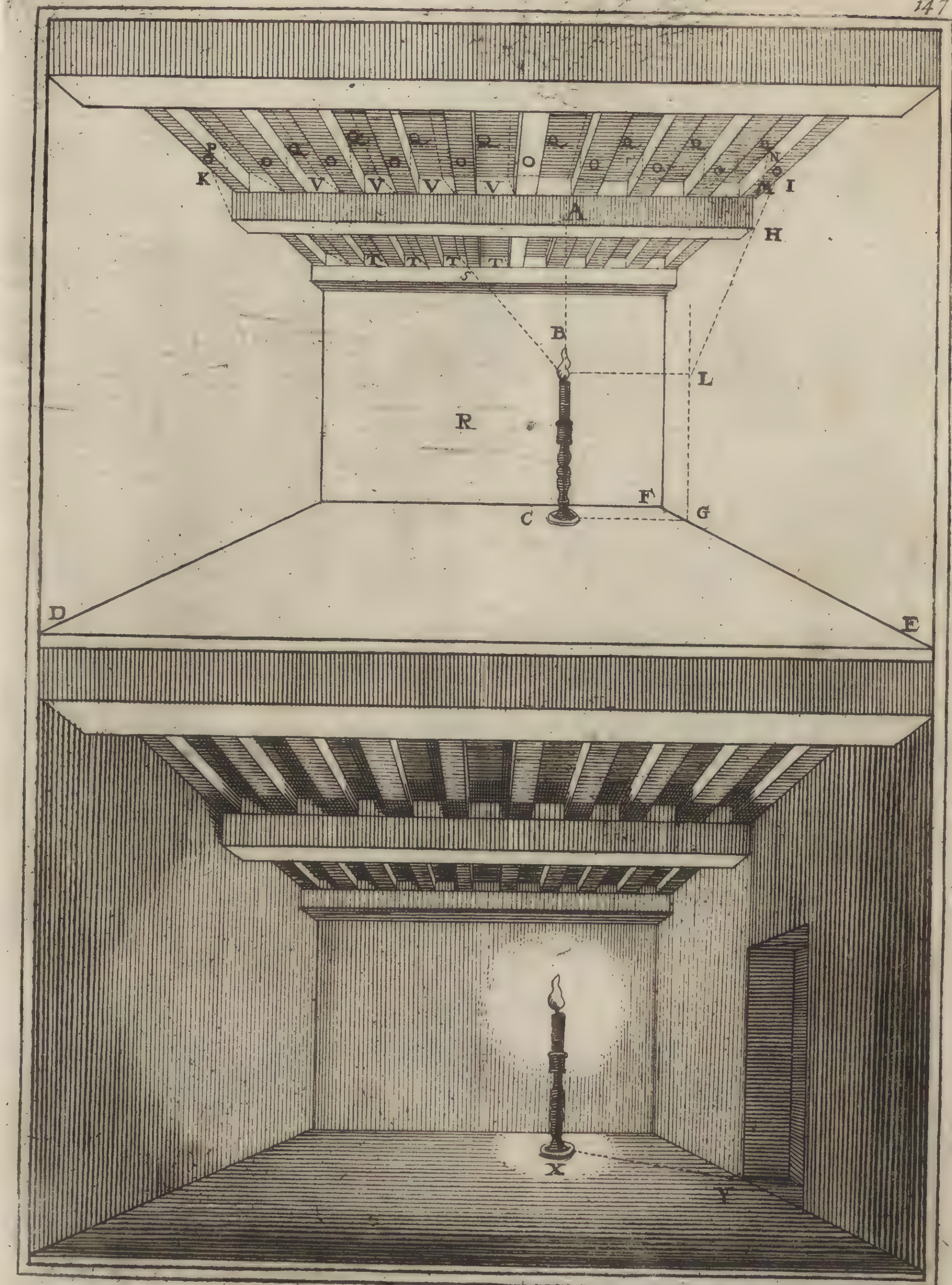
The directions hitherto given, which turn upon the forming of plans, and drawing of lines from the angles of objects, to find the bounds of the ſhadow, would be too tedious here, and the great number of lines neceſſary to be drawn, would render the figure exceeding intricate, on account of the ſeveral beams, ſupporters, and rafters that would occur. This inconvenience drove me to invent a ſhort, eaſy, practical method for the ſame purpoſe, without departing from the rules of art.

The floor being put in perſpective, as was taught in pages 55, and 57, and the illuminating body fixed, we muſt find by means of the baſis of that body where the illuminating point ought to be. To find this point, when the illuminating body is at B, draw from the foot of it C, a parallel to the baſe D E, till it cut the ray E F in the point G, from this point G raiſe a perpendicular G L, and from the flame of the torch B draw a parallel to D E, dividing the perpendicular G L at the point L, and this point L will give the place and length of the ſhadow.

For example; to find the ſhadow of the band A, from the point L draw a line touching the vertex of the angle H, and obſerve where this line L divides the firſt rib, as at the point I, which is the place of the ſhadow's ending. From this point draw a parallel I K, and mark upon the ribs the place of the ſhadow O. And to find the ſhadow of the ſpace betwixt them, draw another line from the point L, touching the vertex of the angle of the firſt rib M, which will divide the angle of the interval at the point N. Now then, from the point N draw a parallel N P, and you will thence have all the ſhadow Q for the beam A.

To find the ſhadow of the joiſts, draw a line from the illuminating point B, touching the angle S, and dividing the bottom of the entablature at the point T. Proceed thus with all the other ribs, and the ſhadow will appear to be longer the farther it is removed from the luminous body. Then mark upon one beam all the points T, and from the point of ſight R, draw lines through each of theſe points, and then the ſhadows of all the other ribs will fall exactly between the bands, as we ſee in the points V V.

The ſecond figure is the ſame with the former, and differs from it only in being ſhadowed, which would have obſcured the letters and the fine lines neceſſary in the other: only here the ſhadow of the jambs of the gate muſt be taken from the foot or the illuminating body, as in X and Y.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To find the Shadow *by the Foot of the Luminary.*

IF the objects be perpendicular to the base line, and higher than the flame of the candle A, we need only draw lines from the foot of the luminary B through the most advanced angles of the objects; for example, C and D of the skreen, *fig.* I. and others from the angle of the wall E. These lines B C, B D, and B E, give the place of the shadow in the points where the angles made by the leaves of the skreen, meet the floor; as also the return of the wall in the point G, from whence perpendiculars must be raised, as G R, which will terminate the shadows given by the candle A.

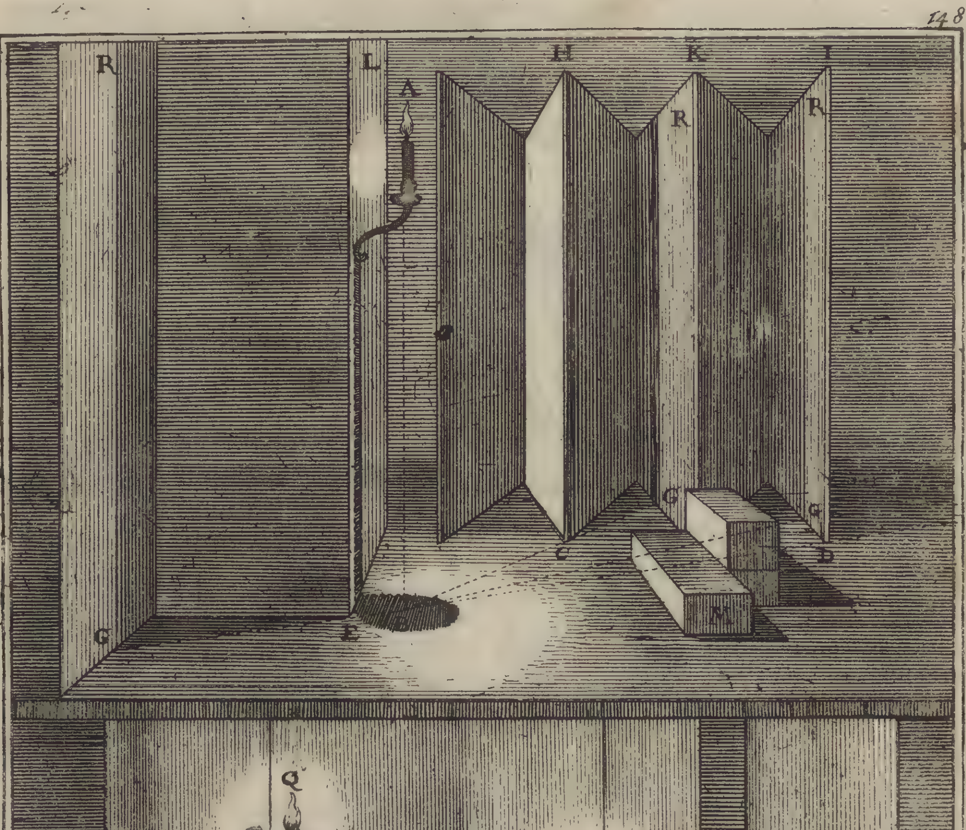
The reason hereof is, that the line A B being parallel to the line C H, D I, K and E L, occasions the flame, in what part soever of the line A B it be found, whether on high in the middle or below, to give a like shadow.

It must here be observed, that this rule only holds good of objects raised above the flame, as these are in the present figure. For such as shew their upper part, as here the object M, the preceding rules take place; that is, lines must be drawn from the foot and flame of the luminary.

The Shadow *doubled.*

WHEN two luminaries shine on the same object, two shadows must be produced, each by means of the luminaries occasioning the respective shadow, and that in proportion to the circumstances of the luminary. If such luminaries when at equal distances be equal, the shadows themselves must be equal; but if there be any disproportion, that is, if one of them be a little bigger than the other, or one of them a little nearer the object than the other, the shadows will be unequal. Thus the object O being illumined by two candles, the one near at hand in P, the other farther off in Q, it is evident, the shadow of the candle P will be deeper than that of the candle Q, as is expressed in the figure.

The rules for such shadows are the same with those already given both for the sun and the torch.


148
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148

The Shadows *of human Figures by Torch-light.*

I HAVE reaſon to hope that the advice already given, not to turn over the page to a new figure, before the preceding one be well underſtood, has been carefully obſerved. Suppoſing therefore my reader to have maſtered what was directed in page 139. for finding the ſhadows of human figures by the ſun; I have little to add as to thoſe in the preſent plate; the line drawn under them, which I uſe as a plan, ſerving indifferently in either caſe. But inaſmuch as the ſhadow projected by a torch is not equal to the body, as is the ſhadow projected by the ſun, a farther conſideration muſt here be added; namely, that inſtead of drawing the lines parallel to one another, they muſt here be all drawn from a center; that is, all the lines drawn over the plan muſt proceed from the foot of the luminary A, and thoſe over and about the figure from the point of the flame, in like manner as for the other ſhadows of the torch; which it would be needleſs here to repeat, the figure itſelf giving abundant ſatisfaction. 3

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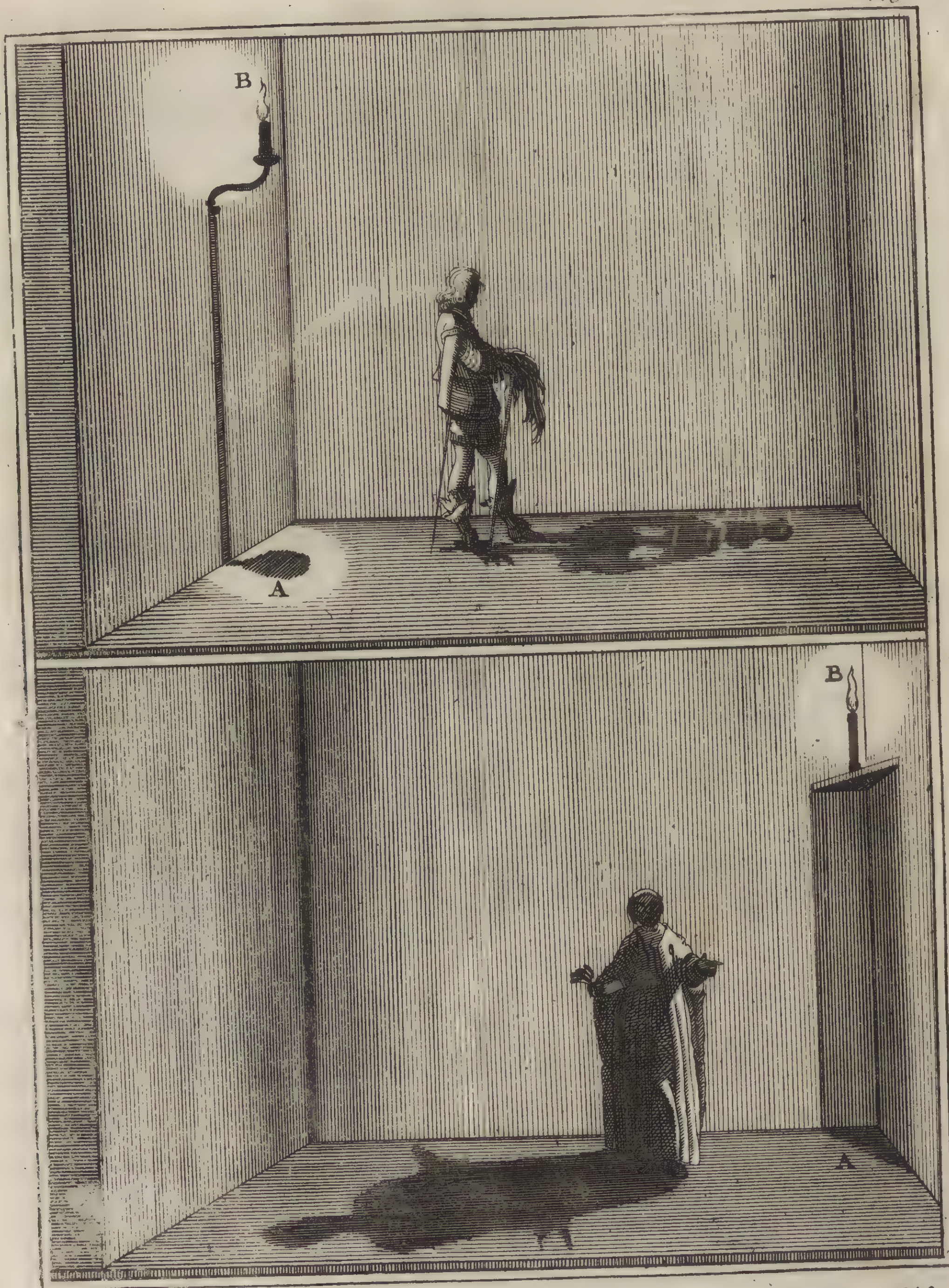

149

The different Diſpoſitions and Heights of Shadows by torch-light.

SHADOWS from the ſun are all caſt the ſame way, and have the ſame diſpoſition; it being impoſſible the ſun ſhould occaſion one ſhadow to tend towards the eaſt, and another towards the weſt, at the ſame time. True, in different times of the day it makes this difference: but never in one and the ſame hour.

But the torch, candle and lamp have always this effect; for in what place ſoever one of theſe luminaries be found, provided there be a number of objects about them, the ſhadows will be caſt various ways; ſome to the eaſt, ſome to the weſt, ſome to the north, and others to the ſouth, according to the ſituation of the objects around the luminary: the foot of which, here repreſented by A, ſerves as a common center from which they all proceed; and the flame here repreſented by B ſhews where they are to terminate, though at different diſtances; as the neareſt produce the ſhorteſt ſhadows, and the remoteſt the longeſt.

Though in the ſecond figure the luminary be not placed in the middle, yet the ſame rule obtains, with reſpect to the ſhadows as in the former figure; being all drawn from the foot of the luminary C, and terminated by lines from the flame D.

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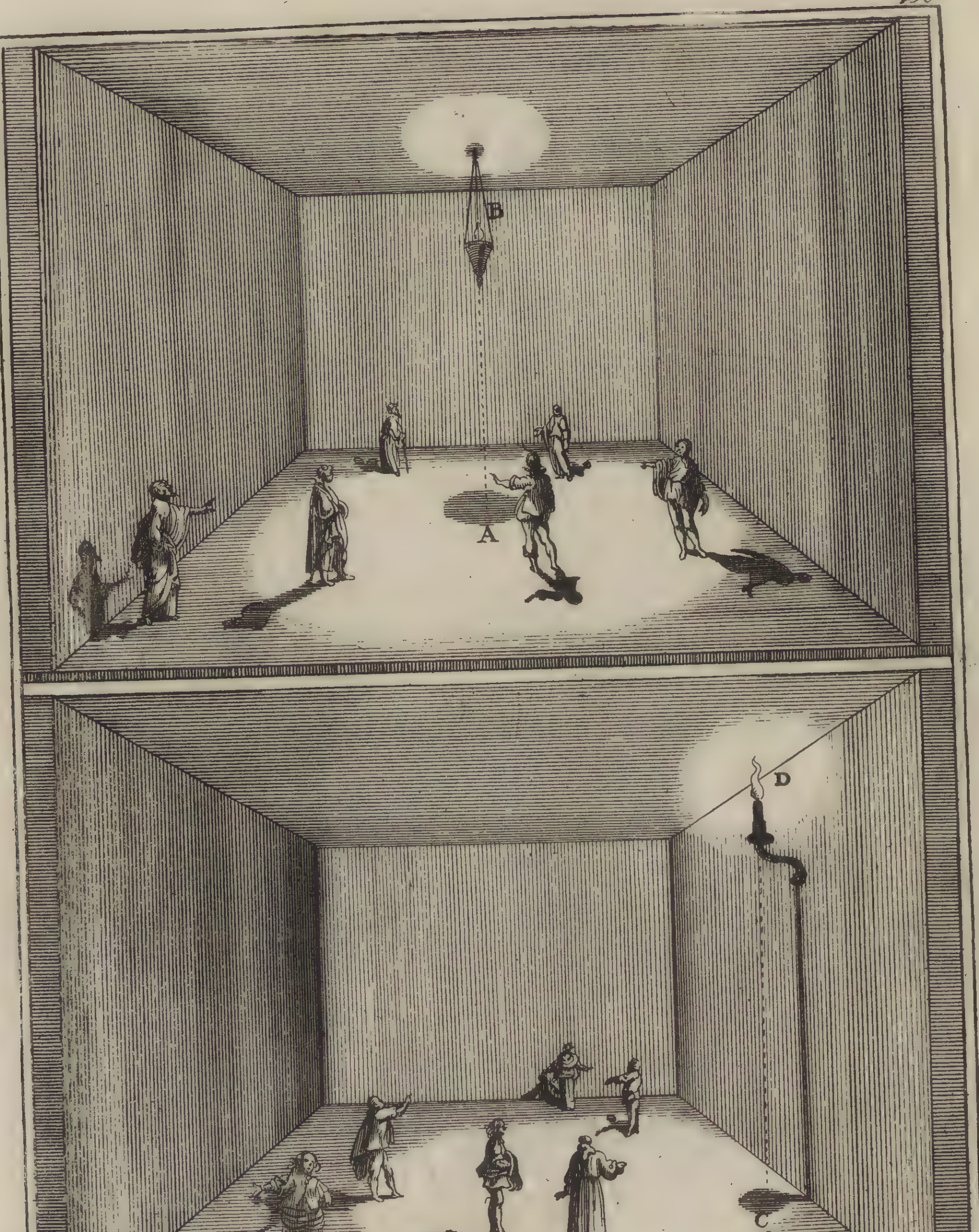
F I N I S.


B
A
D
C